SERVICE INSTRUCTIONS

COMPATIBLE 8MM-SUPER 8MM AUTOLOAD® PROJECTOR

DESIGNS 1620 & 1623

CONSUMER PRODUCTS GROUP

BELL & HOWELL

GENERAL SERVICE DEPT.
7100 McCORMICK ROAD
CHICAGO, ILLINOIS 60645

PART NO. 72797 PRINTED IN U.S.A. JULY 1973

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PRODUCT ONLY

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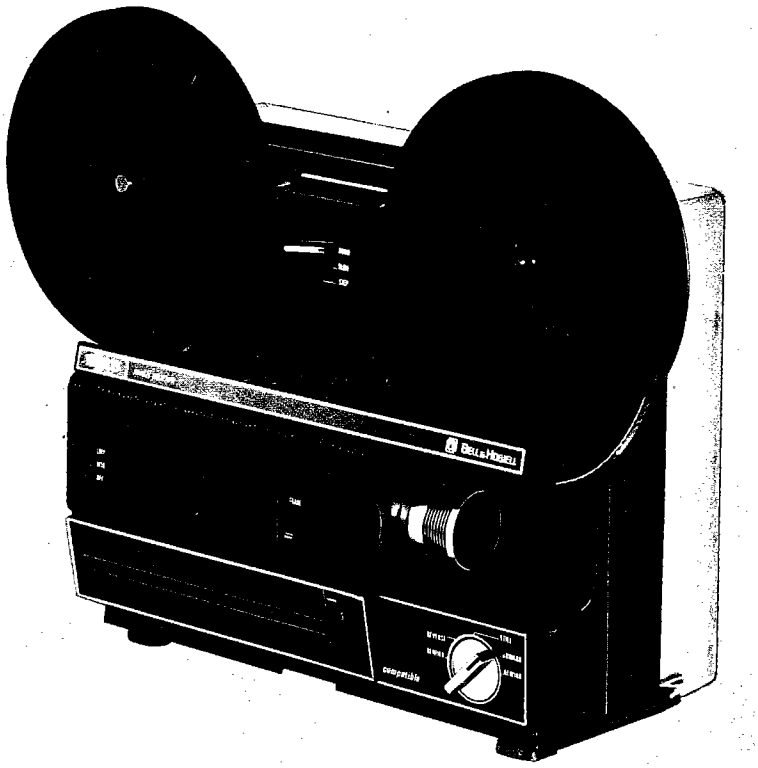


Design 1623 Multi-Motion Regular 8/Super 8 Projector

FEATURE DESCRIPTION LIST

Type of Film	Regular 8 and Super 8
Projector Operation	Still, Forward, Reverse, Fast-Rewind
Rewind Operation	Through-the-system
Still Projection Filter	Perforated metal screen
Framing Control	Lever type
Projection Lamp:	
Design 1620	Type DLE, 80w, 30v
Design 1623	Type DLD, 80w, 30v
Projector Speed:	
Design 1620	Normal (18 fps) only
Design 1623	18 fps, 6 fps and 2 fps
Operating Voltage	120v, 60Hz
Tilt Device	Gravity foot, lever locked
Film Capacity	400 foot
Special Features	Automatic film threading Cam-actuating control knob Convertible R8/S8 reel spindle Still/Search for single frame projection

Introduction

GENERAL.

This manual has been prepared to assist in the repair and adjustment of Bell & Howell Compatible Super 8/Regular 8-mm Movie Projectors Designs 1620 and 1623. Special features and design characteristics are listed on the preceding page.

An illustrated Parts Catalog section is included at the rear of the manual to identify replacement parts and to aid the repairman in the disassembly and reassembly of the equipment. Parts shown in the exploded view illustrations are indexed in a suggested order of disassembly, with attaching parts immediately preceding those parts which they attach. When making specific repairs and adjustments, the serviceman must use his own judgement in eliminating unnecessary steps of the suggested procedure.

DESCRIPTION.

The Design 1623 projector is equipped with the Multi-Motion speed selection feature which permits projection at three different speeds: normal speed (18 fps), slow motion (6 fps) and step-motion (2 fps). Speed selection is controlled by a single knob near the top of the projector between the two reels. Except for this feature, the two projectors are identical in design and operation.

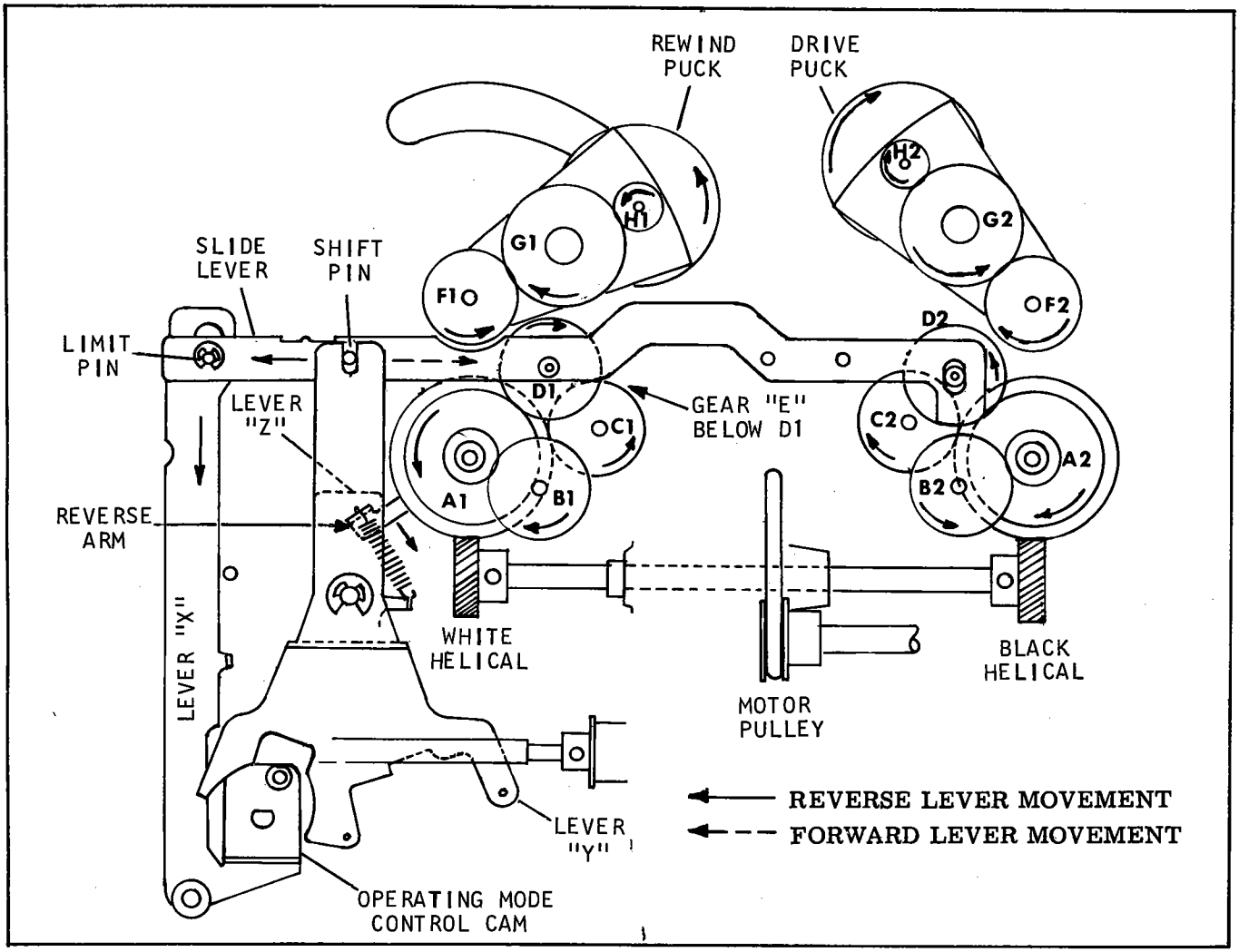


Figure A. Projector Gear Train Operation

The projectors accept both super 8 and regular 8-mm film, and film threading is fully automatic. The selection of forward, reverse or still projection, as well as fast rewind, is made by means of the control knob located beneath the lens. Film rewind is through the system, thus eliminating the need for rethreading and permitting fast rewind of film even in the middle of a reel. With the control knob in the "Still" position, the reels can be turned manually to select any desired frame for extended viewing. A fire shutter automatically drops between the lamp and the aperture to protect the film from heat.

PROJECTOR GEAR TRAIN OPERATION (Figure A).

No matter what the mode of operation, the motor pulley and the helical gears at the ends of the module assembly shaft are always rotating in a clockwise direction as viewed from the lens end of the projector. As a result, the two groups of gears (A1 through D1 and A2 through D2) will always rotate in the directions shown by the arrows on those gears. Gear E, which is mounted on the upper end of the reverse arm behind gear D1, is engaged with the inner gear teeth of gear A1 and also is rotating clockwise.

Figure A shows the position of all gears and levers when the projector is in the STILL mode of operation. The two centering springs effectively hold the slide lever in the center position so that neither of the puck assembly driving gears (D1 and D2) is engaged with the puck arm clutches (F1 and F2). Thus, only the gear train through D1 and D2 are rotating.

When the control knob is moved to the FORWARD mode of operation, the mode control cam rotates in a counterclockwise direction, causing lever Y to pivot about its axis in a clockwise direction. Since the upper forked end of lever Y straddles the slide lever shift pin, the slide lever is shifted to the right, thus engaging driving gear D2 with puck arm clutch assembly F2. The slip clutch tension between F2 and G2 is such that G2 will not rotate immediately and the puck arm is forced to pivot clockwise until the puck makes contact with the film. At this point, slip clutch tension is overcome and the puck is driven through the puck arm gear train to drive the film.

When the control knob is moved to the REVERSE mode of operation, the mode control cam rotates in a clockwise direction, pivoting lever Y counterclockwise and shifting the slide lever to the left. This action engages driving gear D1 with puck arm clutch assembly F1. Once again, slip clutch tension (between F1 and G1) prevents G1 from rotating and forces the entire puck arm to pivot counterclockwise until the puck makes contact with the film. Now slip clutch tension is overcome and the puck is driven through the puck arm gear train to drive the film in the reverse direction.

When the control knob is moved to either REWIND position, the slide lever is once more centered so that both driving gears (D1 and D2) are disengaged. However, this has resulted in a further rotation of the mode control cam, which moves lever Z (hidden behind lever Y) downward.

A system of interconnected levers retracts the film side tension arm and raises the film pressure plate so that the film will have a smooth, unhindered path during the fast rewind operation. A tension spring between lever Z and the lower end of the reverse arm causes the reverse arm to pivot counterclockwise and brings reverse arm gear E into engagement with clutch assembly F1. From this point on, gear operation is the same as that described in "reverse" operation (preceding paragraph) except that the gear ratio between gears E and F1 provides for high speed rotation.

SPEED CHANGE OPERATION (Design 1623 Only).

The Design 1623 projector is equipped with the Multi-Motion feature which provides three operating speeds: normal speed (18 fps), slow motion (6 fps) and step-motion (2 fps). The components which affect the speed changes are shown in Figure B as they appear during normal speed operation, with the nose of the actuator shaft on the highest rise of the speed control cam. In this position, the tip of the cam follower is clearing the multi-track cam gear and the standard (18 fps) pull-down cam is rotating in its normal, uninterrupted fashion.

When the control knob is turned counterclockwise (as viewed from the rear) to the SLOW setting, the link, link arms and control cam move in the direction indicated by the arrows in Figure B. The actuator shaft, under spring tension, drops to the 6 fps cam rise, moving the tip of the cam follower into the 6 fps track of the cam gear. The cam contour in this track is such that the intermittent movement of the actuator arm releases the pull-down cam only six times each second.

Further counterclockwise rotation of the control knob to the STEP setting shifts all parts an additional amount in the direction indicated by the arrows. This places the tip of the cam follower in the inner most track of the cam gear. Here the cam contour is such that the actuator arm releases the pull-down cam only twice each second.

SPECIAL MAINTENANCE PRECAUTIONS.

The removal and installation of projector parts is comparatively simple and, for the most part, requires tools normally available in most repair shops (retaining ring pliers, Bristol

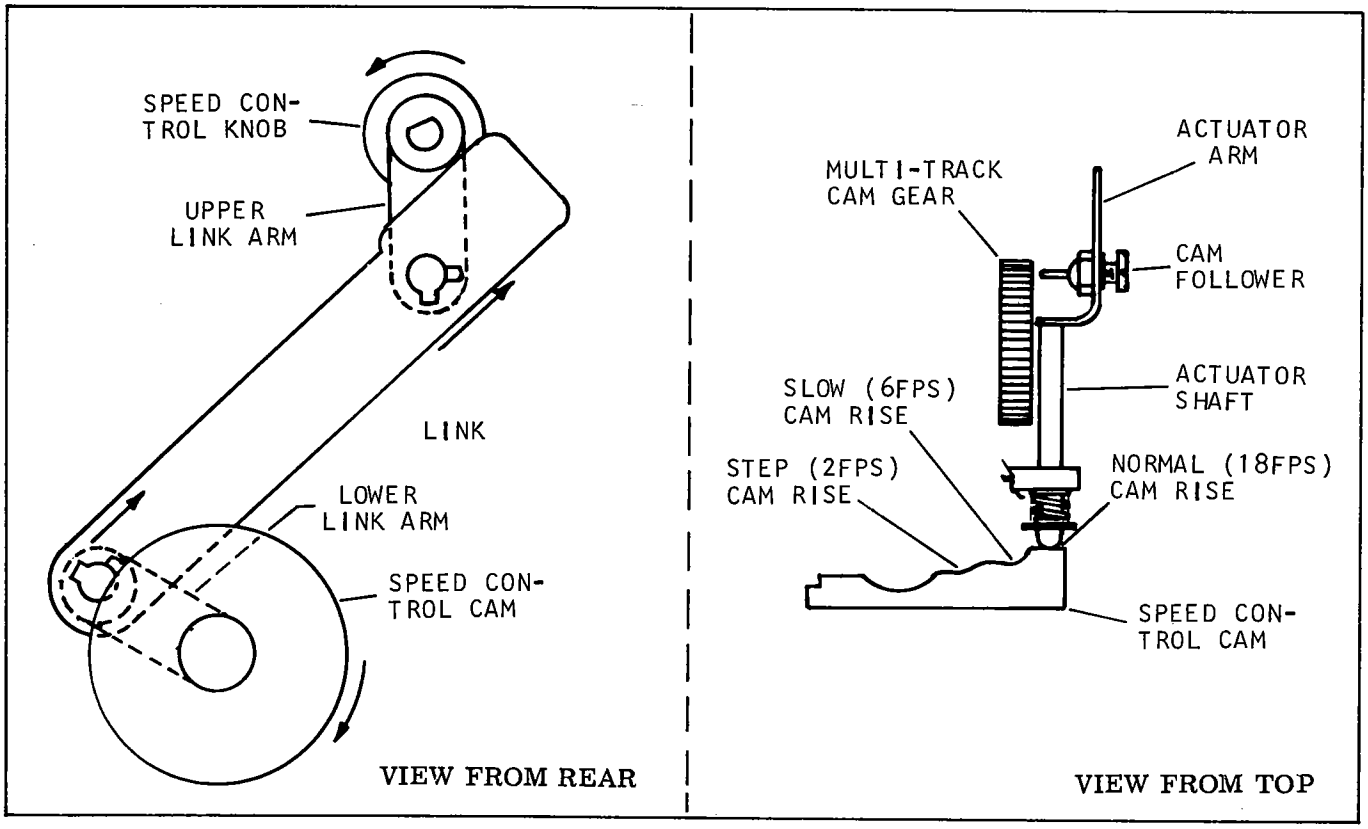


Figure B. Speed Control Operation — Design 1623 Only

setscrew wrenches, assorted screwdrivers and socket hex wrenches, etc.). Where required, special tools and gages are noted in the instructions and illustrated in Figure C.

When repairing equipment, be sure that the work table surface is clean. As parts are removed, group them in an orderly fashion to avoid confusion during reassembly. Clean dirt and old lubricant from parts (except electrical components) by washing them in a pan of solvent. Hardened film emulsion can be removed from film path parts by using alcohol and a wooden implement (tooth pick or orange stick). Do not use a knife or other metal tool to scrape film emulsion from film path components.

After the projector has been repaired, reassembled and adjusted, perform the inspections and test procedures outlined in the Final Test section to insure satisfactory projector operation.

During reassembly, be sure to lubricate parts as noted in the service instructions. If possible, use only recommended Bell & Howell lubricants as listed below. If Bell & Howell lubricants are not immediately available, use only the best grades of ball bearing grease and projector oil obtainable from local commercial outlets.

Grease (Bell & Howell Spec 1956 and Dow Corning No. 33).

BRISTOL SETSCREW WRENCHES REQUIRED FOR MAINTENANCE

Setscrew Size	No. of Flutes	B&H Part Number	
		Handle	Wrench
No. 4-40NC	6	G1271-F1	G1271-X2
No. 6-32NC	6	STK3852-B	STK3863-B
No. 8-32NC	6	G165-F1	G165-X2

NOTE: Wrench G165-F3 is required to tighten setscrew in tool handle.

SPECIAL SERVICE TOOLS		
Tool Number	**Description**	**Reference**
S-014810-27-N1	Shuttle Tooth Centering Gage	Para. 22A
G-9991-N1	Shuttle Tooth Penetration Gage	Para. 22B
TF-47	Standard-8 Test Target Film	Para. 29
TF-68	Super-8 Test Target Film	Para. 29
-----	No. 41 Drill (for gear timing)	Para. 12H

Figure C. List of Special Service Tools

Disassembly Procedure

1. GENERAL INSTRUCTIONS.

a. Before beginning the disassembly procedure, be sure to disconnect the projector line cord from the power source. When the lamp and lens are removed, wrap these items in tissue or cloth and set them aside to prevent accidental damage.

b. When attaching parts (screws, nuts, etc.) are removed, reassemble them loosely to the removed part or to the tapped holes from which they were removed.

c. If repairs require the replacement of electrical items (lamp socket, switch or motor) refer to the wiring diagram, Figure 9, for wiring connections.

d. When removing damaged or defaced nameplates and labels, pry up such items with a knife blade. It may be necessary to use solvent on a Q-tip to loosen the adhesive. Remove all adhesive from the mounting area with a cloth dampened with solvent.

e. When removing riveted parts for replacement, the old rivet must be drilled out with a drill which is equal to, or slightly smaller than the diameter of the rivet.

2. REMOVING PROJECTOR COVERS (Figure 1). Remove covers only as necessary to expose those parts in need of replacement and/or adjustment. The front cover assembly (1) and inner cover assembly (13) must be removed to gain access to the projection lamp, the aperture area and the lower film guide rollers. The back cover assembly (19) must be removed to expose the blower motor assembly and the gearing on the back of the main plate. Note any special precautions.

a. Press up on the front cover latch at the bottom center of the front cover (1) while pulling the bottom of the cover outward. Lift the cover from the locating pins at the top of the main frame. The nameplate (2) and instruction label (3) are adhesive backed and need not be removed unless badly defaced and in need of replacement. The latch parts (5 through 7) and film cutter parts (9 through 11) are riveted to the front cover. If replacements are necessary, these rivets must be drilled out.

b. Place the "R-8/5-8" knob in the "S-8" position. Pull gently but steadily along the upper edge of the inner cover assembly (13) until the spring clips release; then disengage the ears at the lower edge of the cover from the slots in the lower film guide. The nameplate (13A) is adhesive backed and need not be removed unless in need of replacement.

c. Lift up on the lamp ejector (the finger-like lever just below the lamp socket) until the lamp (14) pops up from the socket. Use tissue paper or a cloth to lift out the lamp, thus avoiding fingerprints.

d. Pull outward on the upper edge of the puck cover (15) until the cover retaining ears disengage from the pins in the upper film guide. Remove the cover, disengaging the ear at the bottom center from the slot in the upper film guide.

e. Tip the projector up on either end to expose the bottom back cover retaining screws (17). Remove these black hex head screws and the two eyelets (18). Tip the projector back onto its rubber feet and remove two more hex head screws (16) located above the line cord retainer of the back cover. If the back cover is to be removed completely, the black line cord leads must be disconnected from the wire nuts which retain them. The rubber grommets (20) can be pressed from the back cover. Note that the pad (21) is adhesive backed and the seals (22) and (23) are cemented in place. Do not remove unless replacement is necessary. The line cord (28) can be removed by disassembling the strain relief bushing (26) from the cover.

f. Before the control cover (31) can be removed, the canoe clip (29) must be pried from the face of the lens focus knob and the knob rotated so that the flatted edge of the knob faces the front end of the projector. Turn the projector so the gearing of the main plate is facing you. The control cover assembly (31) is secured with four screws; one is located at the lower front corner of the main plate just below the tilt shaft bracket, two are located horizontally approximately two inches above the first screw and spaced 1-1/2 inches apart, and the fourth is located approximately four inches above the first screw. Remove all the screws and lift off the cover.

3. REMOVING FILM GUIDES AND MAIN PLATE (Figure 2). Remove parts as outlined in the following paragraphs, noting any special precautions.

a. Loosen the setscrews (1) and withdraw the puck and sleeve assemblies (2) and (3) from the puck arm shafts. The trim disc (3A) is cemented to the right puck and need not be removed unless in need of replacement.

b. Design 1623 Only. Loosen the setscrew (4) which secures the link arm (8) to the rear end of the multi-motion shaft (5) on the gear side of the main plate. Withdraw the shaft with the multi-motion knob (6) and retaining ring (7) assembled. Disassemble the link arm (8) from the squared end of the link (9)

and disassemble the opposite end of the link from the link arm of the mechanism module.

c. From the back cover side of the projector, remove seven screws (10) which attach the upper film guide assembly (11). Four of these are located in the upper corners of the main frame; the remaining three are equally spaced across the approximate center of the main plate. Lift off the upper film guide assembly and, if necessary, refer to paragraph 4 for further disassembly.

d. Remove seven screws (13, 14 and 16) and the single washer (15) to free the lower film guide assembly (17). If necessary, refer to paragraph 5 for further film guide disassembly.

e. If the main switch (19) is in need of replacement, disconnect the brown lead spade connector from the lamp socket and the blue and black leads from the wire nuts at the back cover side of the projector. Replacement switches are pre-wired and include the sleeve (19A) and shield (19B).

f. Remove the retaining ring (20) from the upper end of the tilt shaft and withdraw the tilt assembly (21) from the bottom of the main frame. Note the manner in which the extension spring (22) and tilt lock bracket (23) are assembled before removing these parts.

NOTE: Unless the main plate or the main frame are damaged and in need of replacement, it is recommended that these items remain assembled to one another. This will provide more stability during removal of parts from the main plate and will not interfere with the disassembly procedure. If the main plate must be removed from the main frame, proceed as instructed in step g, following.

g. Remove two screws (24) which secure the tilt shaft bracket to the main frame (26). From the front cover side of the main plate, remove the remaining four screws (24). Two of these are located near the top of the main plate approximately five inches apart; the remaining two at the front center and front lower corner of the main plate. Withdraw the main plate assembly (25) toward the front cover side of the projector, first disengaging the drive belt from the motor pulley. Rest the main plate, gear side up, on the open face of the front cover.

4. REMOVING MAIN PLATE COMPONENTS (Figure 3). Remove parts as outlined in the following paragraphs, noting any special precautions.

a. Loosen the setscrew (1) and disassemble the control stop (2) from the end of the control shaft (35). Remove the retaining ring (3) from the end of the forward/reverse shaft and rotate the control knob so that the two setscrews (5) and (6) can be loosened. Slide the forward/reverse shaft toward the mechanism module and lift out the guide bracket (4).

NOTE: If the main plate is still assembled into the main frame, it also will be necessary to remove the two screws (24, Figure 2) which secure the front end of the bracket (4) to the main frame.

b. Remove the forward/reverse shaft (7) with the helical gear (9) assembled. If the gear is to be replaced, loosen the setscrew (8) and remove the gear.

c. Remove the retaining ring (10) and lift out the bracket and bushing assembly (11). Remove the hex nut (12) and screw (13) which attach the support bracket (15) to the upper end of the mechanism module and the second screw (14) attaching the bracket to the main plate stud. Unhook the springs (16) from the holes in the slide bracket (19) and disassemble the springs from the main plate stud. Remove the two retaining rings (17) and (18) that secure the slide bracket (19) to the main plate studs and lift out the slide bracket.

d. Remove the retaining ring (20) and disassemble the still lever (21) from the main plate studs while withdrawing the formed end of the lever from the mechanism module. Check for the presence of a spring (22) between the front end of the T-shaped retractor arm bracket and the hole in the main plate (see inset, Figure 3). On the gear side of the main plate, check for the presence of a spring (30) between the extended arm of the retractor bracket and the hole in the main plate immediately above the arm. If springs are missing or appear badly stretched or loose, they must be replaced.

e. Disassemble the small retaining rings (23) and clutch assemblies (24) from the puck arm mounting posts. Do not disturb the large retaining rings which are assembled to the clutch hubs. Remove the two screws (25) which secure each puck arm guide (27) to the main plate, taking care not to lose the washers located between the guides and the plate. Remove the retaining rings (28) and lift the puck arm assemblies (29) from their mounting studs. If further disassembly of the puck arms is indicated, refer to paragraph 8.

f. Loosen the setscrew (31) and withdraw the helical gear (32) from the control shaft (35). Remove the setscrew (33) and withdraw the control cam (34) from the control shaft. At the front of the main plate, spread the arms of the U-shaped control bracket slightly to relieve the tension of the detent buttons (38) on the "star" portion of the control knob (37). Withdraw the knob and shaft from the control sleeve of the main plate. Loosen the setscrew (36) and disassemble the knob from the shaft. Inspect the detent buttons (38) and, if cracked or badly worn, replace them.

g. Remove the retaining rings (39) and (43) and disassemble the gear support assemblies (40) and (44) from their mounting studs. Lift the black crown gear (41) from the right-hand mounting stud. Disengage the spring (42) from the extended arm of the main plate fast reverse bracket and lift the shim washers (45), white crown gear (46) and reverse

lever assembly (47) from the left-hand mounting stud.

h. From the lamp side of the main plate, remove the single screw (48) located directly above the rear edge of the lamp socket. On the gear side of the main plate, remove the two hex nuts (49) located directly above and below the shutter. When withdrawing the screws (50), note the sleeve spacer (51) assembled to the lower screw. The remaining module attaching screw (50) is located just to the left of the module on the gear side of the main plate immediately below the module shaft. This screw is threaded into a square nut (53) which is captivated in a recess of the module itself. Remove this screw and lift the module assembly from the main plate. Loosen the setscrews (54) and remove the helical gears (55) and (56) from the module shaft. If further disassembly of the module is indicated, refer to paragraph 9.

5. DISASSEMBLING BLOWER MOTOR AND MAIN FRAME ASSEMBLY (Figure 4). Remove parts, as necessary, in their indexed order of disassembly, noting the following special precautions.

a. Press the grommets (2) from the two ears at the top of the main frame and disassemble the locator pins (1) from the grommets.

b. Using a long-nose pliers, compress the open arms of the handle retainer (3) and disassemble the retainer from the end of the handle (5). Pull the handle out through the slots in the main frame and disassemble the remaining retainer. The metal inserts (4) can be removed by inserting the top of a knife blade between the insert and the arm of the retainer and prying carefully until the insert pops free.

c. Loosen the setscrew (6) and withdraw the pulley (7) from the end of the motor shaft. The wire tie (9) with its insulating sleeving (10) is secured to one of spacers (24) with a screw (8). Tip the main frame so that the underside of the base is facing you. Support the motor assembly (12) with one hand while removing the four mounting screws (11), and lift out the motor.

d. Remove five screws (13) and lift the blower cover (14) from the blower housing (19). Loosen the setscrew (15) and withdraw the blower fan (16) from the motor shaft. Remove two screws (17) and disassemble the blower housing from the motor. The air deflector (20) is cemented to the blower housing and need not be removed unless damaged. If replacement is necessary, pry off the deflector with a knife blade.

e. Remove four hex nuts (21) and screws (22) to separate the brackets (23) from the motor assembly (26). Disassemble the spacers (24) from the grommets (25) and press the grommets from the brackets.

f. The rubber feet (27C) are secured to the base of the main frame (27D) with rivets (27A) and (27B) and should not be removed unless obviously in need of replacement.

6. DISASSEMBLING THE UPPER FILM GUIDE ASSEMBLY (Figure 5). Remove parts, as necessary, in their indexed order of disassembly, noting the following special precautions.

a. Remove the end cap screw (1) and washer (2) and disassemble the spindle (3), spring (5), friction bushing (6) and washer (7) from the spindle shaft. Press the super-8 adapter (4) from the standard-8 spindle (3).

b. Turn the film guide over with the top edge facing you. Remove the retaining ring (8) and flat washer (9) and lift the puck shield assembly (10) and torsion spring (11) from the film guide post.

c. Remove the retaining ring (13) and disengage the loop end of the spring (15) from its mounting posts. Lift the trip arm (14) from its post and disengage the opposite end of the spring from the trip arm. Lift the sleeve (16) from the pin of the snubber arm.

d. Turn the film guide over. Remove the retaining rings (17) and washers (18) and disassemble the five rollers (19, 20 and 21) from their posts.

7. DISASSEMBLING THE LOWER FILM GUIDE ASSEMBLY (Figure 6). Remove parts, as necessary, in their indexed order of disassembly, noting the following special precautions.

a. Flip the lamp ejector (1) over so that it is pointing toward the mounting surface (rear face) of the film guide and press the ejector pins from the pin arms of the film guide.

b. Remove the retaining rings (3) and washers (4) and lift the rollers (5) from their posts. Lift the rear snubber (6) from the snubber post of the film guide (7). The friction pad (8) is adhesive backed and need not be removed from the snubber. Note the manner in which the long tension spring (2) is assembled into the slots of the film guide before removing it.

8. DISASSEMBLING THE PUCK ARM ASSEMBLY (Figure 7). Remove parts, as necessary, in their indexed order of disassembly, noting any special precautions.

a. Removal of the screw (1) and hex nut (2) will free all clutch parts (3) through (10) from the puck arm (13). Note the manner in which these parts are assembled.

b. Remove the retaining ring (11) and withdraw the gear and shaft assembly (12) from the puck arm (13).

9. DISASSEMBLING REAR MODULE AND APERTURE PLATE (Figure 8). Remove parts, as necessary, in their indexed order of disassembly, noting the following special precautions.

NOTE: The rear module (4) must be disassembled from the front module assembly in order to replace the drive belt (6) and the main shaft bearing (12). However, all other replacements covered in paragraph 9 can be made with the front and rear modules assembled.

a. To remove the pressure shoe (1), press the face tension levers (20) toward the aperture plate and lift the shoe from the screw heads in the guide rail.

b. To disassemble the rear module (4) from the front module assembly, loosen the two bearing retainer screws (9). Then remove the two screws (2) and square nuts (3) which secure the top and bottom ears of the rear module to the front module. Note that the lower screw also holds the flag end of the support bracket assembly (5). Lift the assembled rear module from the main shaft.

c. Remove two retaining rings (7) and lift the lamp shield (8) from the posts of the rear module. Remove the screws (9) and square nuts (10) and disassemble the bearing retainer (11) and bearing (12) from the rear module. The lamp socket (15) is secured to the rear module with two screws (13) and hex nuts (14).

d. Do not remove the focus knob (17) unless in need of replacement. The knob is retained by a spring (16) inside the lens bore. Pry out the spring to release the knob.

e. Unhook the ends of the springs (18) from the notches at the front of the lens bore. Remove the screw (19) and disassemble the tension lever assembly (20) from the lens bore.

f. The aperture plate assembly (24) is secured to the front module with four screws (22) and (23) and hex nuts (21). One of the nuts is hidden behind the arm of the fire shutter assembly. Remove the screws and lift out the aperture plate assembly (24) and the aperture retractor slider (25). Check the tension of the side tension arm (24B) with a gram gage. Tension should be between 160 and 180 grams. If the tension does not fall between these limits, remove the side tension spring (24A) and adjust tension as illustrated in Figure E.

g. Design 1623 Only. Loosen the setscrew (26) in the hub of the multi-motion lever (27) and disassemble the lever and the multi-motion cam (28) from the locating ears at the top of the front module. Be careful not to lose the detent ball (29) and spring (30).

10. DISASSEMBLING THE FRONT MODULE (Figure 9). Remove parts, as necessary, in their indexed order of disassembly, noting the following special precautions.

a. Rotate the shutter manually to expose the mask shifter bracket (2). Remove the screw (1) and lift off the bracket. Invert the module and unhook the tension spring (3) from the special screw (33) and the lower end of the format stabilizer lever (6). Remove the retaining ring (4) and washer (5) and disassemble the stabilizer lever from the pivot post of the front module. Remove the screw (7) and flat washer (8) and disassemble the format shifting bracket assembly (10) from the front module. The hex nut (9) is in a pocket on the other side of the module below the forward-reverse arm assembly (42).

b. Invert the module with the shutter facing up. Loosen the setscrew (11) and lift the shutter assembly (12) from the main shaft. Remove the screw (14) spring tension washer (15) and flat washer (16) from the shuttle arm pivot post. Screw (17) and washer (18) secure the shuttle adjustment plate (19) to the shuttle assembly (20) and need not be removed unless the plate and/or shuttle are to be replaced. The shuttle and plate are a snug fit on the pivot post and it may be necessary to pry up carefully with a knife blade until these parts are free. Remove the cam shoes (21) from the shuttle. Slide the pull-down cam (23) up the main shaft, bringing the shim washers (22) and the cam driver (24) with it.

NOTE: If the repairs are in the main shaft area and you do not expect to disturb the gear train, lock the timing of the gears by inserting a No. 41 drill through the timing holes in the front module and the large white gear (36) as shown in Figure D before continuing with the disassembly procedure.

c. Loosen the setscrew (25) in the drive gear (26) and withdraw the main shaft (28) down through the gear and front bearing. Lift the drive gear (26) and bearing spacer (27) from the module. The retaining ring (29) and washer (30) need not be removed from the main shaft.

d. Note the manner in which the torsion spring (40) is assembled. Remove the retaining ring (31) and washer (32) used to captivate the spring loop on the stud of the forward-reverse arm (42). From the opposite side of the module, remove the special screw (33) which secures the guide plate (34) to the module.

e. Flip the bracket arm of the actuator shaft assembly (58) up out of the way. Remove the retaining ring (35) from the gear post at the upper end of the gear train (37). Lift the upper link from the post and swing it counterclockwise so that the white compound gear (36) can be removed. Loosen the upper bearing retainer screw (50) and shift the notched square nut (51) so that the lip of the nut no longer extends over the large loop of the gear train lever encircling the main shaft boss. Lift the gear train (37) from the module, disengaging the lower link from the gear stud and the large loop from the main shaft boss.

The torsion spring (40) is secured at the lower end of the gear train with a screw (38) and washer (39) and need not be removed unless in need of replacement.

f. The bushing of the forward-reverse arm (42) is secured at the opposite side of the module with the retaining ring.

g. Before removing the fire shutter (46), note the manner in which the legs of the torsion spring (44) are engaged. Also note the manner in which the retractor spring (48) and lever (49) are assembled.

h. Remove two screws (50) and (52) and nuts (51) and (53) and disassemble the bearing retainer (54) and bearing (55) from the module.

i. Remove the retaining ring (56) and spring (57) from the front end of the actuator shaft (58) and withdraw the shaft from the module. Note that Design 1620 projectors use a second retaining ring (56) to hold the shaft in the retracted position, since those models operate only at the normal speed. Do not remove the cam follower screw (58A) from the actuator bracket unless it is in need of replacement.

Reassembly and Adjustment

11. GENERAL INSTRUCTIONS.

a. When the reassembly procedure includes the staking of rivets or other parts, such operations should be undertaken before any other reassembly is attempted. Be sure to support the plate or casting solidly while performing the riveting or staking operation.

b. Be sure to remove all old lubricant and apply fresh lubricant before installing parts. Except as otherwise noted in the instructions, the recommended grease is Bell & Howell Spec. 1956. Apply lubricant sparingly, wiping away excess with a clean, lint-free cloth. Be very careful not to get lubricant on the drive belt or the rubber surface of the drive pucks.

c. When installing items which are adhesive-backed or which must be cemented in place, be sure to remove all old adhesive from the mounting area with a cloth moistened with solvent. If the adhesive backing must be "activated," moisten the adhesive with trichloroethylene and allow ten to fifteen seconds for the adhesive to become tacky. Locate the item (nameplate, data plate, etc.) squarely, start one edge, and smooth down all over with a clean, lint free cloth. Excess adhesive can be removed with solvent.

d. When installing wired electrical items, refer to the wiring diagram (Figure 9) for proper leadwire connections. In most instances, stripped lead ends are twisted together and secured with a wire nut.

12. REASSEMBLING THE FRONT MODULE (Figure 9). Reassemble parts as outlined in the following paragraphs, noting any special precautions.

a. With a brush, apply grease lightly to the module area beneath the staked multi-track cam and to the gear teeth of the cam.

b. If the cam follower screw (58A) was distrubed or replaced, assemble the screw to the actuator assembly (58). Turn the screw in until the spacing between the staked end of the nut and the underside of the screw head is 0.065 inch.

c. Lightly grease the shaft of the actuator assembly (58) and insert the shaft through the ears of the front module (59). Assemble the spring (57) to the front end of the shaft and install the retaining ring (56). Since the Design 1620 projector does not have the multi-motion feature, a second retaining ring (56) is installed near the rear end of the shaft so that the shaft is immovable.

d. Assemble the main shaft bearing (55) into the bearing pocket in the front module, with the locating notch in the bearing at the top of the pocket. Assemble the bearing retainer (54) to the front module, engaging the small tab of the retainer with the locating notch in the bearing. Hold the square nut (53) in the lower pocket on the inside of the module and install the lower screw (52), tightening the screw securely. Install the upper screw (50) and nut (51) in the same manner, but do not tighten the screw.

e. Lightly grease the slot in the module through which the leg of the shuttle retractor lever (49) will protrude. Assemble the retractor lever to the front module and install the retractor spring (48), formed lip up, over the lever. Secure the spring with the screw (47).

f. Lightly grease the fire shutter pivot post and assemble the fire shutter assembly (46) over the post. The rounded tip at the formed end of the fire shutter must rest on the lip of the retractor spring (48). Assemble the spacer (45) to the post, flanged face down. Assemble the spring (44) over the spacer, short leg down. Rotate the short leg of the spring counterclockwise until it catches behind the ledge at the top of the module. Rotate the long leg of the

spring clockwise and hook it behind the small tab at the knee-bend of the fire shutter. Secure the fire shutter parts with the screw (43). Actuate the retractor lever (49) to make certain that the fire shutter moves freely, loosening screw (43) slightly if necessary.

g. Lightly grease the bushing of the forward-reverse arm assembly (42) and insert the bushing through the hole in the front module. Secure the assembly with the retaining ring (41).

h. Secure the inner loop of the torsion spring (40) to the lower front corner of the gear train bracket with the screw (38) and washer (39). Temporarily remove the upper bearing retainer nut (51) and lightly grease the module post on which the large gear (36) will be installed and the boss around the main shaft opening in the module. Assemble the gear train assembly (37) to the module, with the lower of the two free links over the gear post and the large hole at the top of the forward-reverse lever over the main shaft opening boss. Reinstall the nut (51) with lip positioned to trap the upper edge of the forward-reverse lever. Insert a No. 41 drill up through the hole in the module located at approximately one o'clock in relation to the gear post. Rotate the staked cam gear so that the V-shaped depression on the face of the gear is at 12 o'clock as shown in Figure D. Assemble the compound gear (36), small gear hub down, over the gear stud so that the timing hole in the gear is engaged by the drill inserted through the hole. Carefully mesh the lower gear of (36) with the cam gear. Then swing the free upper link of the gear train over onto the upper end of the gear post and install the retaining ring (35).

i. Lightly grease the area of the module where the guide plate (34) will be assembled. Locate the guide plate over the two bosses of the module and hold in place while installing and tightening the special screw (33). Rotate the forward-reverse arm assembly (42) to the three o'clock position and assemble the free end of the torsion spring to the post at the end of the arm. Secure with the washer (32) and retaining ring (31). Spring tension will pull the forward-reverse arm down slightly in a clockwise direction, uncovering a small hole in the module just above the front end of the arm. Rotate the arm slightly counterclockwise until the hole in the arm is aligned with the hole in the module. From the opposite side of the module, insert the short leg of a 5/64 inch Allen key wrench through both holes, thus locking the arm in the reverse mode.

j. Loosely assemble the setscrew (25) to the drive gear (26). Assemble the bearing spacer (27) into the recessed opening for the main shaft and carefully place the drive gear, gear teeth up, on top

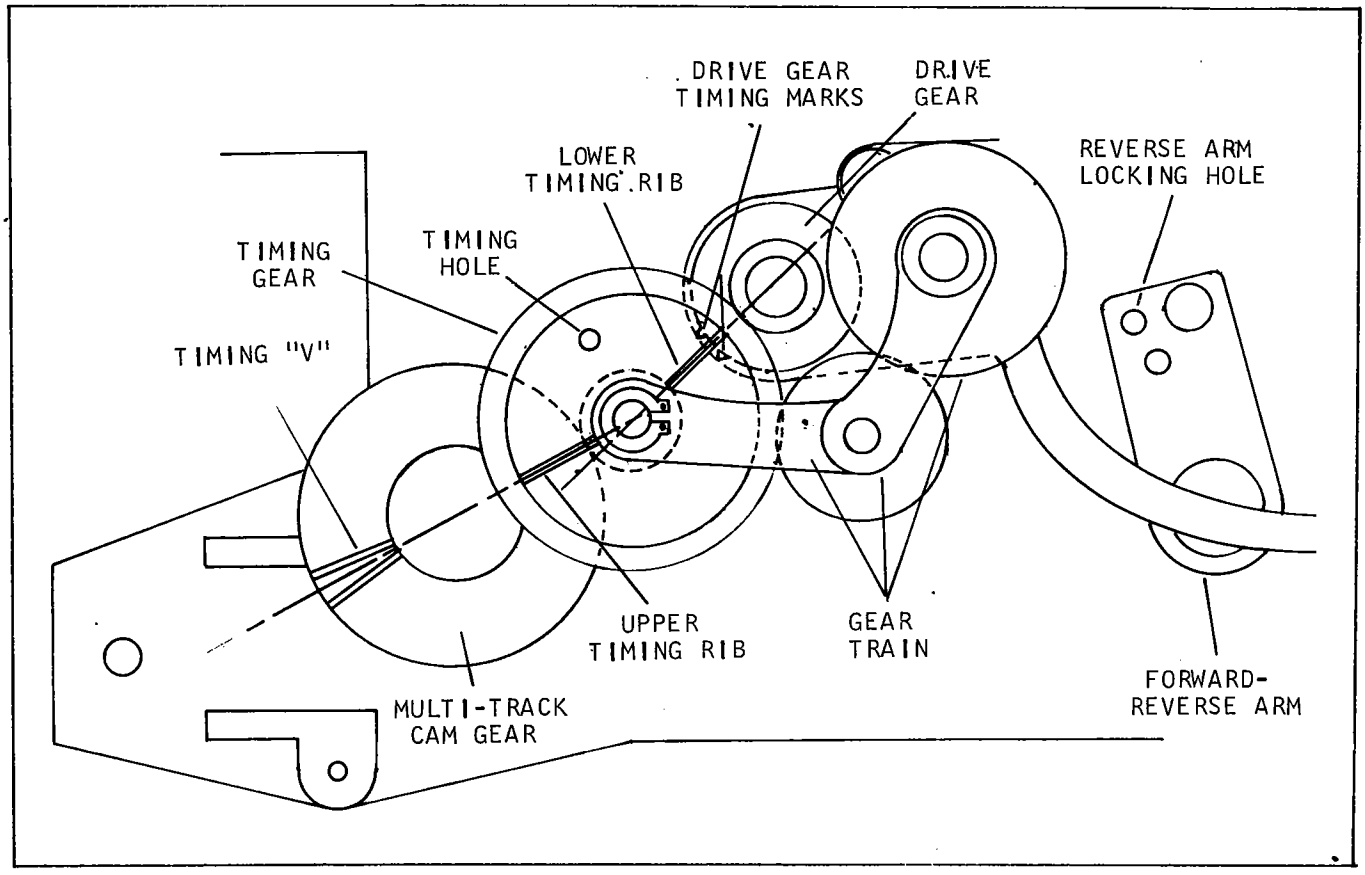


Figure D. Timing the Module Gears

of the spacer, aligning the scribed mark on the face of the gear with the lower timing mark of gear (36) as shown in Figure D. Lightly oil the main shaft (28) and assemble the retaining ring (29) into the ring groove of the shaft. Assemble the washer over the long end of the shaft and down against the retaining ring. Insert the long end of the shaft carefully up through the front bearing, the bearing spacer and the drive gear, holding the gear so that the alignment is not disturbed. Insert a 0.003 inch shim between the washer (30) and front bearing and press all parts together so that the shim is held firmly while tightening the drive gear setscrew (25) against the flat on the main shaft. Remove the shim and check the shaft for end play.

k. Note the two small nibs on the outer diameter of the cam driver (24) opposite the post of the driver. When the cam driver is installed on the main shaft, gear teeth down, the lower aligning mark of the large white gear (36) must be located between the two nibs or slightly toward the clockwise nib (see Figure D). Lightly grease the cam driver and assemble it to the main shaft. Assemble the pull-down cam (23), flat side down, and two shim washers (22) to the main shaft, locating the aligning hole in the cam over the post of the cam driver. Lightly grease the shuttle pivot post of the module and the cam shoe area of the shuttle (20). Assemble the cam shoes (21) to the shuttle and make certain that the actuator shaft assembly (58) is flipped down so that the flag of the actuator bracket will be below the shuttle. Assemble the shuttle to the pivot post and over the pull-down cam. Assemble the shuttle adjustment plate (19) to the shuttle with the screw (17) and washer (18), the hole in the upper end of the plate over the shuttle pivot boss and the stud at the lower end of the plate in the recessed post of the module. Tighten the screw finger-tight. Assemble the bowed washer (15), concave face up, over the shuttle pivot stud and secure all parts with the screw (14), flat washer (16) and hex nut (13).

l. Place a 0.003 inch shim on top of the pull-down cam (23) and install the shutter assembly (12), hub up, onto the main shaft. The shutter aligning hole farthest from the shutter setscrew opening must locate over the cam driver stud. Align setscrew opening with the flat on the main shaft and, while pressing down firmly against the shim, tighten the setscrew (11) securely. Remove the No. 41 drill and 5/64 inch key wrench used for aligning purposes.

m. Lightly grease the holes and banna slot in the format shifting bracket assembly (10) and assemble the bracket to the module. The special screw (33) must protrude through the banna slot and the bracket stud on the opposite side of the module must engage the notch in the shuttle adjustment plate (19). Apply grease to the hex nut (9) and rotate the forward-reverse arm (42) counterclockwise so that the nut can be dropped into the pocket of the module underneath the arm. Assemble the washer (8) to the screw (7) and secure the shifting bracket to the module by turning the screw into the preassembled nut until tight. Assemble the format stabilizer lever (6) to its pivot post and secure with the washer (5) and retaining ring (4), with the knee-bend of the lever caught behind the stud at the rear upper corner of the shifting bracket. Assemble one loop of the spring (3) over the special screw (33) and hook the other end into the hole at the lower end of the lever (6).

n. Turn the module over (shutter side up) and rotate the shutter so that the mask shifter bracket (2) can be assembled to the upper front corner of the format shifting bracket. The small bent ear of the bracket (2) must engage the hole in the shifting bracket. Install and tighten the screw (1).

13. REASSEMBLING REAR MODULE AND APERTURE PLATE (Figure 8). Reassemble parts as outlined in the following paragraphs, noting any special precautions.

a. Design 1623 Only. Lightly grease the shaft and lobes of the multi-motion cam (28). Assemble the spring (30) and detent ball (29) into the detent hole in the front module and hold in place with shim stock while inserting the cam shaft through the support holes in the module. When the cam is fully seated, withdraw the shim stock and secure the multi-motion lever (27) to the flat on the end of the cam shaft with the setscrew (26). This must be done with the high lobe of the cam at the 12 o'clock position and the lever pointing toward the seven o'clock position. When the lever is secure, press in on the end of the actuator shaft while rotating the cam clockwise until the shaft can be released into one of the cam rises.

b. If the side tension arm (24B) or spring (24A) were removed or replaced, reassemble as follows. Place the aperture plate on the work bench with the spring stud up and away from you. Assemble the side tension arm (24B) over the stud with the tension arm prongs down and engaging the slots in the aperture plate. Assemble the spring (24A) to the stud with the spring loop toward you and the ends of the spring inserted into the holes in the tension arm. Press the loop of the spring down until it seats. The side tension arm should exert a tension of 160 to 180 grams. If this tension is not as specified, it will be necessary to remove the spring and strengthen or weaken the tension as shown in Figure E.

c. Lightly grease the tab of the retractor slides (25), the four hex nuts (21) and the three contact surfaces of the module alongside the aperture area. Assemble the hex nuts (21) into the pockets of the module on the fire shutter side (the fire shutter must be shifted to install the front upper nut). Assemble the retractor slider (25) into the channel in the front module. Plan the aperture plate assembly (24) in position behind the lens bore, taking care to see that the shuttle teeth enter the shuttle slot cleanly. Hold the aperture plate while inverting the front module, checking to see that the long finger of the mask shifter bracket (2, Figure 9) is lying between the two prongs of the aperture plate mask shifter. Install four screws (22) and (23) and hold aperture plate in toward the module while tightening the screws.

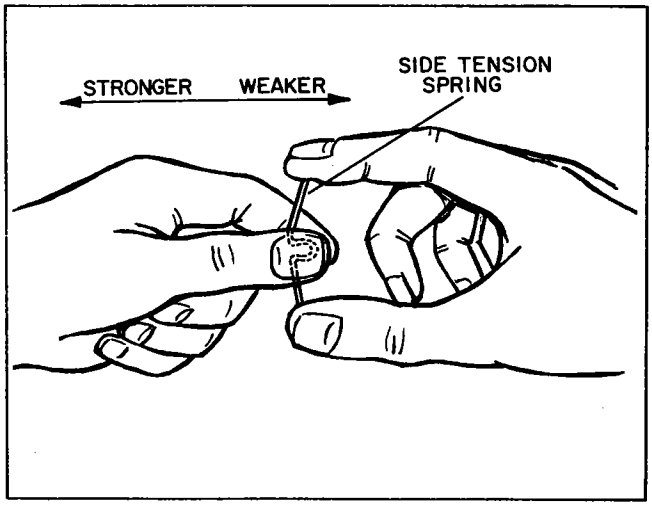


Figure E. Adjusting Aperture Plate Spring Tension

d. Assemble the face tension lever assembly (20) to the lens with the hole in the bracket to the outside of the bore and the narrow legs of the levers toward the aperture plate. Secure the assembly to the lens bore with the screw (19). Assemble the short loops of the tension springs (18) to the two levers and hook the long loops into the notches at the front edge of the lens bore.

e. Lightly grease the shaft portion of the lens focus knob (17) and assemble through hole in lens bore. Secure the knob with the retaining spring (16), snapping it over the knob shaft and under the notch in the lens bore.

f. Assemble the lamp socket (15) into the rear module (4) so that the locating notch in the lamp seating hole points toward the wall where the lamp shield (8) will be mounted. Secure the socket with the screws (13) and hex nuts (14).

g. Note the positioning notch in the outer diameter of the main shaft bearing (12). Assemble the bearing into the pocket in the rear module (4) so that this notch engages the small rectangular boss on the inner wall of the pocket. Assemble the bearing retainer (11) over the bearing, aligning the retainer holes with those in the module. Hold the retainer and invert the rear module so that the socket side faces up. Place a square nut (10) in the pockets for the retainer screws (9) and install the two screws. Tighten both screws securely; then back them off one full turn. Assemble the lamp shield (8) over the posts on the rear module and secure with the retaining rings (7).

h. Loop the drive belt (6) around the shutter pulley. Apply one drop of oil to the main shaft bearing (12) and assemble the rear module (4) to the front module guiding the main shaft through the bearing. Before fully seating the rear module, assemble the flag end of the support bracket (5) into the recess in the rear module and guide the support bracket stud into the mating hole in the format shifting bracket. Hold the square nut (3) in the pocket at the upper end of the front module and loosely assemble the upper screw (2) through both modules and into the nut. Align the tapped hole in the support bracket (5) with the lower hole in both modules and install the lower screw (2) and nut (3) finger tight. While pressing up on the lower ear of the rear module just below the support bracket (5), tighten both screws securely; then tighten the two bearing retainer screws (9). Spin the shutter to make sure that the shaft is rotating freely and without binding.

i. Before installing the pressure shoe (1), adjust aperture mask framing (paragraph 21) and shuttle tooth centering and penetration (paragraph 22). When installing the pressure shoe, the rail of the shoe must face toward the aperture plate and the edge with the aperture opening must be in toward the module. Press both face tension levers to withdraw the fingers from the aperture plate. Slip the pressure shoes into position over the guide rail screw heads. Release the face tension levers.

14. REASSEMBLING THE PUCK ARM ASSEMBLY (Figure 7). Reassemble parts as outlined in the following paragraphs, noting any special precautions.

a. Lightly grease the entire length of the gear and shaft assembly (12) with Dow Corning No. 33 grease. Insert the shaft through the puck arm (13) and secure with the retaining ring (11).

b. Lightly grease the hub of the puck arm and assemble an idler gear (10), double boss up, to the hub of the puck arm. Assemble the base clutch (9), hub facing up, to the boss, aligning the "D" hole in the clutch with the "D" of the boss. Assemble the clutch washer (8) to the hub, followed by the second idler gear (7), double boss down. Assemble the washer (6) and clutch disc (5) to the boss.

c. Assemble the washer (3) and compression spring (4) to the long screw (1) and insert the threaded end of the screw through the puck arm boss. Hold the hex nut (2) in place on the opposite side of the puck arm and turn the screw into the hex nut. Refer to paragraph 25 for torque check and adjustment.

15. REASSEMBLING THE LOWER FILM GUIDE ASSEMBLY (Figure 6). Reassemble parts as outlined in the following paragraphs, noting any special precautions.

a. Place the lower film guide (7) on the work bench with the roller post facing up and the bottom edge facing you. Assemble the flat tension spring (2) into the slots at the right side of the film guide, short formed end at the top with the bend facing to the right.

b. Place the rear snubber (6) on the work bench with the roller posts facing up and the bottom edge toward you. Remove the backing from the friction pad (8) and assemble the pad to the right side of the snubber with the upper edge of the pad flush with the top surface of the snubber and the end nearest you butted against the projecting ear at the bottom right corner of the snubber.

c. Lightly grease all roller posts and assemble the guide rollers (5), counter bore up, and washers (4) to all four posts. Secure these parts with the retaining rings (3). While holding the lower end of the flat spring (2) to the right, assemble the snubber (6) to the post of the film guide, pressing it fully down into place. Release the lower end of the flat spring (2). Snap the lamp ejector (1) into the formed fingers of the film guide.

16. REASSEMBLING THE UPPER FILM GUIDE ASSEMBLY (Figure 5). Reassemble parts as outlined in the following paragraphs, noting any special precautions.

a. Lightly grease all five roller posts of the film guide and snubber assembly (22). Assemble the 1/2-inch long rollers (21), counter bore facing up, to the upper two posts, the metal roller (20) to the bottom center post, and the 5/16-inch long rollers (19) to the lower right-hand posts. Place a washer (18) over each of the rollers and secure these parts with the push-on retaining rings (17). The prongs of the rings should be angled up and gripping the posts. Turn film guide over with top edge facing you.

b. Assemble the sleeve (16) over the pin of the film guide snubber. Lightly grease the trip arm mounting post of the film guide with Dow Corning No. 33 grease. Hook the open end of the spring (15) on the hook of the trip arm (14) and assemble the arm to the post with the flange of the arm beneath the plastic ear of the guide and the pin of the snubber engaged in the track of the arm. Stretch the spring (15) until the loop end can be placed over the post approximately 3 inches to the right of the trip arm post. Secure with the push-on retaining ring (13).

c. Remove backing from the two bumper pads (12). With a tweezers, locate one bumper pad on the underside of the rectangular boss just to the left of the puck shield mounting post. Press firmly with the fingers. The second pad must be secured to the post located at the far right center of the film guide and must be positioned between the 180 and 270 degree quadrant of the post (facing toward you and left on a diagonal line). Lightly grease the puck shield mounting post with Dow Corning No. 33 grease. Assemble the puck shield (10) to the mounting post, stud facing up. Engage the long end of the torsion spring (11) into the hole at the lower end of the puck shield. Wind the short end of the spring one full turn clockwise and hold while assembling the spring loop down over the post. Secure these parts with the washer (9) and push-on retaining ring (8).

d. Turn the film guide over with top edge facing you. Assemble the flat washer (7), the friction bushing (6) and compression spring (5) over the take-up spindle shaft and down into the spindle recess in the film guide. Snap the super-8 adapter (4) into the standard-8 spindle (3) and assemble the spindle and adapter onto the spindle shaft. Secure all parts with the washer (2) and end cap screw (1).

17. REASSEMBLING BLOWER MOTOR AND MAIN FRAME ASSEMBLY (Figure 4). Reassemble parts as outlined in the following paragraphs, noting any special precautions.

a. Activate the adhesive backing on the data plate (28) and allow adhesive to become tacky. Assemble the data plate into the recess on the bottom of the base and press down firmly to insure adhesion.

b. Assemble the rubber feet (27C) into the recesses in the main frame casting and secure them to the main frame with the rivets (27A) and (27B).

c. Assemble two grommets (25) into each of the motor mounting brackets (23) and insert the spacers (24) into the grommets. Assemble the brackets, feet facing out, to the motor assembly (26) with the four screws (22) and hex nuts (21).

d. Apply adhesive (B&H Spec. 935) to the air deflector (20) and the mating surface of the blower housing (19). Allow adhesive to dry for approximately 15 seconds and assemble the deflector to the housing. Assemble the blower housing to the motor assembly with the two screws (17), first installing a wire tie (18) on the screw closest to the blower opening.

e. Assemble the blower fan (16) to the motor shaft. While pressing against the fan end of the shaft, visually center the fan within the blower opening and tighten its setscrew (15) securely. Assemble the blower cover (14) to the blower housing with the five screws (13).

f. Position the assembled blower motor (12) on the base of the main frame (27) with the mounting holes aligned, and install and tighten the four mounting screws (11). Assemble the insulating sleeves (10) to the wire ties (9) and (18) and secure wire tie (9) to the motor mounting insert indicated in Figure 7 with the screw (8). Assemble the motor pulley (7) to the motor shaft with the pulley hub toward the motor. Dip the setscrew (6) in shellac and, while aligning the face of the pulley with the end of the shaft, install and tighten the setscrew securely.

g. Assemble a metal insert (4) into each of the handle retainers (3). The purpose of the insert is to spread the arms of the retainer. Pinch together the arms of one retainer and assemble the retainer into the square hole at one end of handle (5). The U-shaped end of the retainer should face in toward the center of the handle. Insert the opposite end of the handle up through one slot in the top of the main frame, across the main frame and down through the second slot. Assemble the second retainer to the end of the handle in the same manner as the first was installed.

h. Assemble a grommet (2) to each of the two ears extending out from the top of the main frame, with the profile of the grommet matching that of the ear. Press a locator pin (1) into each grommet.

18. REASSEMBLING THE MAIN PLATE COMPONENTS (Figure 3). Reassemble parts as outlined in the following paragraphs, noting any special precautions.

NOTE: If the main plate (57) was removed from the main frame in order to replace either of these items, the main plate should be reassembled into the main frame before beginning the installation of main plate components. Assemble the main plate from the front cover side, aligning the four mounting holes (two at the top and two near the front edge) with those in the main frame casting. Make certain that the main plate is squarely and fully seated; then install the four mounting screws (24, Figure 2).

a. Lightly grease around the studs at the upper ends of the main plate levers and at the curved lip at the lower front end of the shorter lever. Assemble the white helical gear (56) to the front end of the module shaft and the black helical gear (55) to the rear end of the module shaft. Both gear hubs must be facing in toward the module. Tighten the gear setscrews (54) just enough to hold. Lightly grease the square nut (53) and insert it into the rectangular opening in the mechanism module, just to the right of the lens mount opening. Carefully assemble the complete mechanism module assembly to the main plate, rotating the module slightly while inserting it through the cut-out opening. Position the module by engaging the slot at the lower end of the module retractor bracket over the main plate lever stud. Install one screw (50) from the gear side of the main plate, threading it into the square nut (53). The other two screws (50) are installed from the lamp side of the main plate through holes in the module which are directly above and below the shutter. A sleeve spacer (51) must be installed on the lower screw. Assemble a hex nut (49) to the end of each screw and tighten securely. Dip the setscrew (54) of the white helical gear in shellac and, while holding the gear centered within the rectangular opening in the main plate, install and tighten the setscrew securely. From the lamp side of the main plate, install the fourth module mounting screw, inserting it through the hole above the rear edge of the lamp socket. Lightly grease each helical gear and the studs located above these gears.

b. Assemble the trigger spring (42) to the reverse lever assembly (47) by hooking the spring loop through the ear of the lever from the side closest to the lever gear. Lightly grease both sides of the lever around the large diameter hole. Loosely assemble the large white crown gear (46) to the lever assembly by sliding the edge of the crown gear under the reverse lever gear and engaging the gear teeth. Assemble the lever and gear to the stud directly above the white helical gear, meshing crown gear teeth with helical gear teeth. Assemble three shim washers (45) onto the stud. Assemble the left-hand gear support assembly (44) to the stud with the support bosses facing out and the small diameter boss closest to the module assembly. Make certain that the lower support assembly gear is meshing with the pinion of the crown gear (46). Install the retaining ring (43). With a tweezers, engage the free end of the trigger spring (42) over the notched spring arm of the shorter main plate slide lever.

c. Assemble the black crown gear (41) to the stud located directly above the black helical gear (55). Assemble the right-hand gear support assembly (40) to the stud, with the support bosses facing out and the small diameter boss closest to the module assembly. Make certain that the lower support gear is meshing with the pinion of the crown gear. Install the retaining ring (39).

d. Assemble the control knob (37) to the end of the control shaft (35) which has the shortest flat. Make certain that the shaft is fully seated; then tighten the setscrew (36) securely against the flat. Assemble the detent buttons (38) into the holes at the ends of the U-shaped bracket of the main plate, the large buttons facing in toward each other. Lightly grease the "star" portion of the control knob and the full length of the control shaft. While spreading the arms of the U-shaped bracket, insert the shaft through the stud in the main plate until the detent buttons will ride in the star portion of the knob when the arms are released. Lightly grease the gear of the control cam assembly (34) and assemble the cam to the rear of the control shaft, cam gear toward the main plate. Insert a 0.005 inch shim between the hub face of the control knob and the end of the main plate stud. While holding the knob against the shim and the control cam against the main plate, secure the cam to the control shaft with the setscrew (33). Assemble the helical gear (32) to the control shaft, gear hub facing out. Dip the setscrew (31) in shellac. Hold the gear firmly against the cam while tightening the setscrew (31) against the flat of the control shaft.

e. Hook the closed loop of the spring (30) over the extended arm of the long retractor bracket, which is staked near the front edge of the main plate. Hook the opposite end of the spring through the hole in the main plate located approximately 3/4-inch above the extended arm. Hook the circular end of the extension spring (22) through the hole at the front end of the T-shaped retractor arm bracket which is staked to the lamp side of the main plate. Hook the opposite end of this spring into the hole in the main plate which is approximately two inches above the arm (see inset, Figure 3).

f. Assemble the puck arm assemblies (29) to their respective main plate studs and install the retaining rings (28), burr side out. Pull outward on each puck arm assembly to seat the ring against the outside edge of the groove. This will assure a slight clearance between the boss of the puck arm and the retaining ring. Assemble two screws (25) to each puck arm guide (27) and install a washer (26) over the end of each screw. Assemble a puck arm guide over the top edge of each puck arm and tighten the screws while lifting up lightly on the guide. Raise and release the puck arm assemblies several times to make certain that they drop freely. If binding occurs, check for proper seating of the puck arm guide. Assemble

end and assemble the remaining two eyelets (18) into the grommets in the lower lip of the back cover. Install and tighten the two screws (17); then tip the projector back on its rubber feet and tighten the two screws (16) securely.

f. Engage the ear at the bottom center of the puck cover (15) with the corresponding slot in the upper film guide and press against the puck cover until it snaps in place.

g. Assemble the projection lamp (14) into its socket and press down firmly until seated. Remove finger prints with tissue or a soft, clean cloth. Engage the two ears at the bottom edge of the inner cover (13) with corresponding slots in the lower film guide and press the cover forward until it snaps in place.

h. Assemble the film cutter spacer (11), the film cutter (10) and film cutter guide (9) to the inside of the front cover (12) and secure these parts with the two rivets (8). Note that the pointed ends of the spacer and guide must face toward the nearest (front) side of the cover and that the lettering on the guide must face up.

i. Rest the top cover on its top surface with the open side of the cover away from you. Position the latch (7) in the recess at the bottom center of the cover with the serrated end of the latch toward you and facing up. Assemble the spring (6) on top of the latch with the formed lip of the spring away from you and facing up. Assemble the small diameter of the bushing (5) through the spring and latch, and secure all parts with the rivet (4).

j. Activate the adhesive backing of the instruction label (3) and nameplate (2) and allow adhesive to become tacky. Assemble the instruction label to the inside of the front cover in the unbossed area above the film cutter. Assemble the nameplate into the recess at the front side of the cover. Smooth down all over to insure proper adhesion. Install the front cover assembly (1) by engaging the holes in the top edge of the cover with the two locating pins in the main frame; then pressing the lower edge of the cover inward until it latches in place.

21. APERTURE MASK ADJUSTMENT (Figure F).

The adjustment (horizontal framing) of the standard-8/super-8 aperture masks can be accomplished with the mechanism module removed from the projector. Since the adjustment results can only be checked visually, framing should be checked with test film after the projector has been assembled (paragraph 29) and readjusted as necessary.

a. Lift the format shift lever up to the super-8 position and visually check the centering of the super-8 mask in the aperture opening. If the mask is not equidistant from the sides of the aperture opening, carefully turn the super-8 eccentric adjusting screw (Figure F) to shift the mask in the proper direction. Clockwise rotation of the screw will shift the mask to the right.

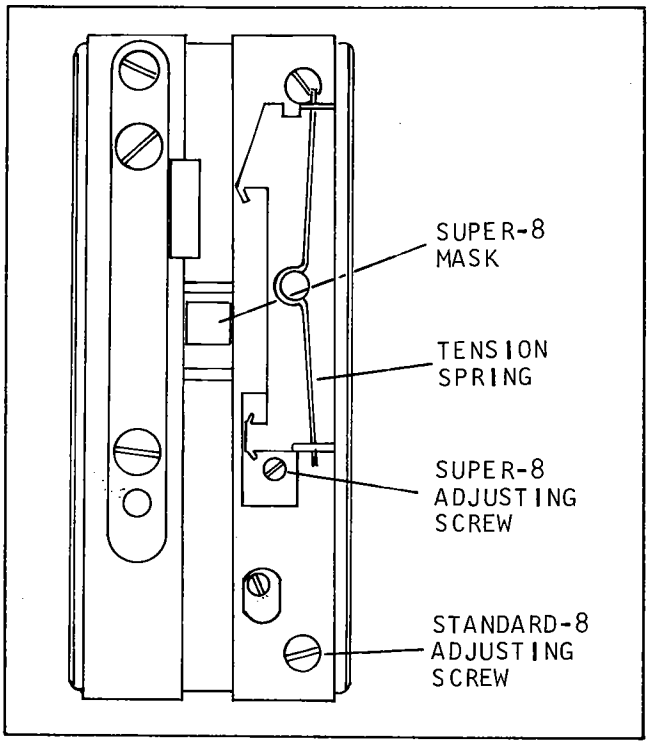


Figure F. Aperture Mask Adjustment

b. Press the format shift lever down to the regular-8 position and, through the lens bore, visually check the centering of the regular-8 mask in the aperture opening. If the mask is not equidistant from the sides of the aperture opening, carefully turn the regular-8 eccentric adjusting screw (Figure F) to shift the mask in the proper direction. Clockwise rotation of the screw will shift the mask to the right.

NOTE: The control cover need not be removed from the projector to adjust the framing with the module assembly installed. The super-8 adjusting screw can be reached through the large lens bore opening in the control cover; the regular-8 adjusting screw through the smaller hole in the control cover just below the lens bore opening.

22. SHUTTLE TOOTH ADJUSTMENTS (Figure G).

Shuttle tooth adjustments are made after the projector is assembled but before the control cover, lower film guide and back cover are installed. Remove the pressure shoe from in front of the aperture plate and proceed as follows.

a. Shuttle Tooth Centering Adjustment.

(1) Place the projector on its rear end with the lens bore facing up. Place the format lever in the super-8 position.

(2) By rotating the motor pully clockwise, manually advance the shuttle until the teeth are at the top of the stroke and at maximum protrusion. For centering purposes,

a clutch assembly (24), retaining ring out, to each puck arm mounting stud and secure with the small retaining rings (23).

g. Lightly grease the formed end of the still lever (21) as well as the lever mounting stud and the retractor stud protruding through the elongated slot near the front edge of the main plate. Assemble the still lever to its mounting stud, with the formed end resting on top of the retractor of the mechanism module and the opposite end of the lever engaging the retractor stud. Secure the lever with the retaining ring (20).

h. Lightly grease the stud of the bracket and stud assembly (19) and the inner surface of the bracket around all elongated slots. Assemble the bracket onto the two shoulder studs of the main plate while captivating the small bosses of the gear support assemblies (40) and (44). Secure the bracket to the left stud with the small retaining ring (18) and to the right stud with the large retaining ring (17). Assemble the loop end of the two springs (16) to the stud protruding above the large retaining ring (17). Hook the opposite ends of the springs into the bracket holes to the left and right of the stud, shifting the bracket to the left or right so that minimum stretching of the spring is required. Secure the pointed leg of the support bracket (15) to the tapped stud with the screw (14), but do not tighten the screw. Secure the opposite leg of the support bracket to the upper end of the mechanism module with the screw (13) and hex nut (12). Tighten both screws (13) and (14) securely.

i. Assemble the bracket and bushing assembly (11) to the stud on the main plate, engaging the slot at the upper end of the bracket with the stud of the slide bracket (19). Secure the bracket to the stud with the retaining ring (10).

j. Assemble the helical gear (9) to the ring-grooved end of the forward/reverse shaft (7), with the gear hub facing away from the groove. Align the setscrew hole in the hub with the flat on the shaft and tighten the setscrew (8) just enough to hold. Lightly grease the helical gear and the turned-down diameter of the shaft; then insert the end of the shaft into the stud protruding from the mechansim module. Assemble the two setscrews (5) and (6) into the tapped holes in the module stud, but do not tighten. Assemble the guide bracket (4) over the rear end of the control shaft (35) and bring the forward/reverse shaft forward until its helical gear (9) meshes with the control shaft helical gear (32) and the end of the shaft protrudes through the guide bracket. At this point, secure the bracket to the main frame with the two screws (24, Figure 2); then assemble the retaining ring (3, Figure 3) to the end of the forward/reverse shaft.

k. Visually inspect the position of the forward/reverse helical gear (9) in relation to the control shaft. The gear teeth should be centered above the shaft and must not be binding against the guide bracket. If necessary, reposition the gear; then dip the setscrew (8) in shellac and tighten it firmly against the flat of the forward/reverse shaft. Reach around the projector and rotate the control knob fully clockwise until the knob detents (rewind position). Insert the pin of the forward/reverse arm locking tool (Figure B) into the hole in the mechanism module above the format shift lever. Move the module forward/reverse arm assembly until the pin drops in place to lock the arm. Dip setscrew (5) in shellac and assemble it to the module stud in which the forward/reverse shaft (7) was inserted. Rotate control knob counterclockwise to the next detent position (reverse mode). Rotate the control knob slightly clockwise and the helical gear (9) clockwise (toward you) to remove backlash; then tighten the setscrew (5) securely. Remove the locking tool from the module and rotate the control knob counterclockwise until it detents twice (Forward mode). Remove the exposed setscrew (6), dip it in shellac and reassemble it to the module stud, tightening it securely. Rotate the knob through all positions to check the detenting action and return it to the "Still" position (up and down).

l. Assemble the control stop (2) to the end of the control shaft with the setscrew hole at the top and the long ear of the stop pointing toward the mechanism module. Insert a 0.004-inch shim between the stop and the guide bracket. Hold the stop against the shim while tightening the setscrew (1) against the flat of the control shaft.

m. Make all wiring connections as shown in the wiring diagram, Figure 9. The line cord connections will not be made until just before the back cover is installed (paragraph 18). The wire nuts used are Bell & Howell part no. 82794 and they must be crimped after the twisted leads are inserted.

NOTE: If the projector is to be run with the back cover removed, a special "fused" line cord (S-012603-2FX1) can be used. Attach the black clip of the fused line cord to the stripped end of the white motor lead and the red clip to the black slide switch lead.

19. INSTALLING THE MAIN PLATE AND FILM GUIDES (Figure 2). Reassemble parts as outlined in the following paragraphs, noting any special precautions.

a. Normally, the main plate is not removed from the main frame unless either the frame or the main plate have been damaged and are to be replaced. If such is the case, reassemble the main plate (25) into the main frame (26) from the lamp side. Make certain that the plate is squarely and fully seated in the recess of the frame with mounting holes aligned. Two of the mounting holes are located near the top of the plate approximately 5 inches apart; the remaining two holes are located near the front edge of the plate at the center and bottom corner. Install four screws (24) finger-tight; then, from the gear side of the plate, secure the tilt shaft guide bracket to the main frame with the remaining two screws (24). Tighten all screws securely.

b. Assemble the short hooked end of the spring (22) to the small hole in the tilt lock bracket (23).

Rest the projector on the rear end of the main frame (lens opening facing up) and assemble the long hooked end of the spring to the hole in the inner corner of the tilt shaft guide bracket. Assemble the tilt lock bracket to the guide bracket, inserting the tab of the guide bracket through the rectangular hole in the lock bracket. Hold the lock bracket so that the square tilt shaft holes in both brackets are aligned. Hold the tilt assembly (21) with the curved edge of the tilt base facing up, and insert the tilt shaft through the round hole in the base of the frame and the square holes in the bracket. Assemble the retaining ring (20) to the end of the shaft and place projector back in normal position.

c. Assemble the main switch (19) to the lower film guide assembly (17) with the two screws (16). The brown and blue wire leads of the switch must be positioned near the top edge of the film guide. Connect the brown switch lead to the lamp socket terminal which is closest to the main plate. Assemble the yellow lead to the remaining lamp socket terminal. While drawing the leads through the hole in the main plate, slip the front end of the film guide under the format shift lever and seat the locating bosses into the holes in the main plate. Assemble the washer (15) to one screw (14) and insert this screw through the hole at the approximate center of the film guide. Install the remaining four screws (13) and (14) and tighten all five screws securely. Make certain that all leads are pulled through the main plate so that no slack remains.

d. Rotate the control knob counterclockwise until the knob detents. Assemble the upper film guide assembly (11) to the main plate while rotating its puck shield down so that the puck arm shaft can protrude through the opening. The rear lower edge of the upper film guide must seat behind the upper edge of the lower film guide. Secure the upper film guide with the seven screws (10). Check the action of the puck arm and shield. Both must operate freely. Also check to make certain that the vertical edge of the film guide just back of the metal roller is positioned in front of the module projection just above the aperture plate.

e. Turn the projector so that the gear side of the main plate is facing you. Hold the link (9) so that the rounded end is down and the straight side is toward the right. Assemble the lower end of the link to the link arm already assembled to the module cam shaft, engaging the key slot with the link arm key boss and pivoting the link clockwise. Preassemble a setscrew (4) to the link arm (8) and assemble the link arm to the upper end of the link (9) in the same manner. Assemble the retaining ring (7) into the ring groove of the multi-motion shaft (5). Assemble the multi-motion knob (6) to the end of the shaft closest to the retaining ring and tighten the setscrew against the flat on the shaft. Insert the shaft through the upper film guide until the retaining ring (7) is against the surface of the film guide. Assemble the link arm (8) to the shaft and, while holding the retaining ring and link arm against the film guide bosses, tighten the link arm setscrew (4) against the flat on the shaft.

f. Preassemble the setscrews (1) to the puck assemblies (2) and (3). Leave the setscrew wrench in the setscrew while assembling the pucks to their respective shafts. Align the setscrew with the flat on the shaft and push the puck in as far as possible while tightening the setscrew. The trim disc (3A) is used only on the right-hand puck (3) and must be cemented in place with adhesive (B&H Spec. 327).

20. REASSEMBLING AND INSTALLING THE PROJECTOR COVERS (Figure 1). Reassemble and install covers as outlined in the following paragraphs, noting any special precautions.

a. The control nameplate (31A) is adhesive backed. Activate the adhesive and allow it to become tacky; then carefully assemble the nameplate into the recess in the control cover (31) and smooth it down with a soft cloth. Rotate the lens focus knob until the flatted edge is facing the front end of the projector and hold the control cover in position while installing the four screws (30). Rotate the lens focus knob until the flatted edge faces the rear end of the projector and assemble the canoe clip (29) into the hole in the face of the lens focus knob.

b. Thread the stripped ends of the line cord (28) through the cord opening in the back cover (27) from the painted side. Pull the cord through the hole until the stripped ends reach the far inside corner of the back cover; then assemble the strain relief bushing (26) to the cord on the painted side of the cover and press the bushing into the hole in the cover. Press the reel retainer clip (25) onto the hub protruding from the center of the back cover cord retainer and slip the insulating sleeve (24) over the end of the wire tie on the inside of the cover. Bend the wire tie around the line cord.

c. The seals (22) and (23) are cemented to the inside walls of the back cover (top and sides) with Bell & Howell Spec. 935 adhesive. In all instances, the edge of the seals should protrude approximately 1/8-inch beyond the open edge of the cover. The side seals (23) should be positioned as far as possible toward the top of the cover. The top seal (22) is to be installed with the notched edge facing out. The blower opening pad (21) is adhesive backed. Remove the paper backing and assemble the pad around the louvered opening in the cover, with the narrow edge of the pad positioned against the side wall of the cover. Press down at edges of pad to insure full adhesion.

d. Twist together the stripped ends of one line cord lead and the white lead from the motor and install a wire nut. Similarly join the second line cord lead and the black lead from the main switch. Captivate all leads with the wire tie which is attached to the motor mounting insert.

e. Assemble the rubber grommets (20) into the four mounting holes in the back cover (19) and lift the cover up into position against the main frame. Assemble two metal eyelets (18) into the grommets just above the line cord retainer and install two screws (16) finger tight. Tip the projector up on

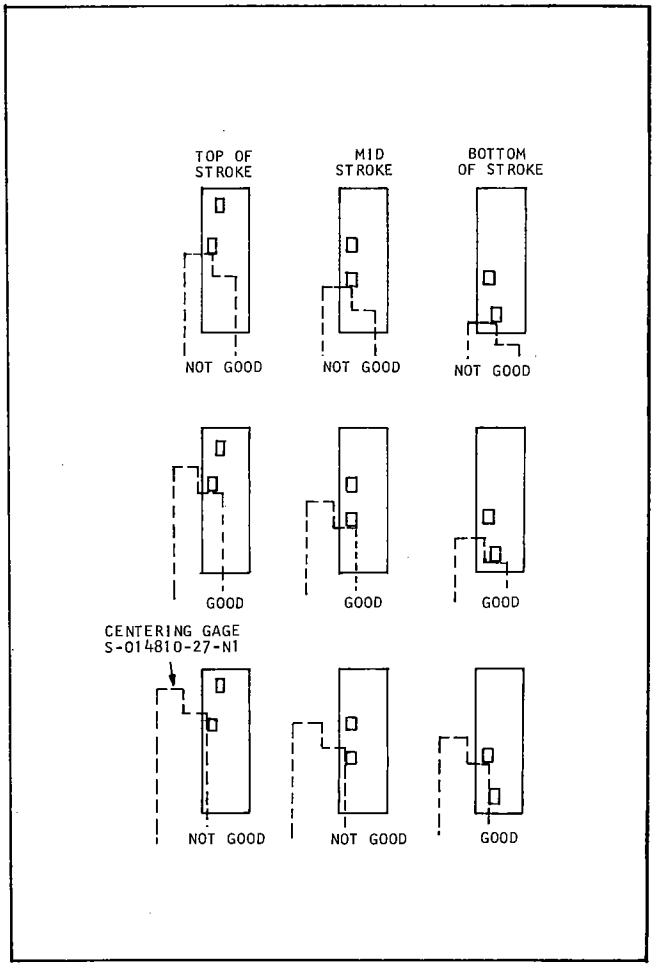


Figure G. Adjusting the Shuttle Teeth

shuttle tooth protrusion can be exaggerated by backing out the cam follower screw (Figure G). Place the control knob in the REWIND mode.

(3) Lay a strip (6 to 8 inches long) of super-8 film leader in the film channel and place the control knob in FORWARD mode. With a magnifying glass, check to see that the shuttle teeth are centered in the film perforations. Then manually advance the shuttle until the teeth are at the bottom of their stroke, just prior to withdrawing from the perforations, and again check the centering of the teeth.

(4) If the teeth are not centered in the perforations, slightly loosen the two screws in the shuttle adjustment plate (Figure G). Insert the blade of an offset screwdriver into the triangular openings near the center of the plate and, while watching the shuttle teeth, rotate the screwdriver up or down until centering is obtained; then tighten the adjustment plate screws securely and recheck centering per steps (1) through (3).

b. Shuttle Tooth Protrusion Adjustment.

(1) Remove the face tension lever assembly (20, Figure 8) from the lens bore and place the projector on its rear end (lens bore facing up).

(2) With the control knob in the FORWARD mode, manually rotate the motor pulley clockwise to advance the shuttle teeth to the top of the stroke and at maximum protrusion.

(3) Using the Auto Rewind limit side (0.030 to 0.036 inch) of the shuttle penetration gage (G-9991-N1), lay the gage in the lower half of the film channel, "GO" end up, and slide the gage up to the protruding shuttle teeth. This end of the gage should clear the shuttle teeth.

(4) Reverse the gage ("NO-GO" end at the top) and again slide the gage up to the shuttle teeth. This end of the gage should strike the lower shuttle tooth.

(5) Leave the gage in the film channel and manually advance the shuttle. The shuttle tooth should move the gage to the lower end of the film channel before the teeth retract.

(6) If the shuttle teeth fail to meet the "GO-NO GO" limits specified, manually bring the shuttle teeth to the top of the stroke as instructed in step (2). Adjust the cam follower screw with a 3/16-inch open end wrench until protrusion is within the limits of 0.030 to 0.036 inch. Turning the follower screw in decreases the protrusion, backing the screw out increases the protrusion.

23. MULTI-MOTION LINKAGE ADJUSTMENT (Design 1623 Only). The operation of the multi-motion feature is discussed in the Introduction section of these instructions and illustrated in Figure B. The only adjustment necessary is to make certain that the multi-motion levers are oriented and secured in such a manner that the nose of the actuator shaft is riding the proper cam rise, or lobe, for each of the three settings. Figure B illustrates the positions of the cam, actuator shaft and levers when the knob is in the "normal" speed position. If this is properly set, the "slow motion" and "step" positions will be automatically correct.

24. SUPPLY SPINDLE TORQUE ADJUSTMENT. The torque of the front (supply) spindle of the upper film guide assembly must be sufficient so that the film reel does not coast and spill film when the control knob is moved to the "still" position. If torque is so weak that film spills, disassemble the spindle parts from the upper film guide assembly (paragraph 6), clean the friction bushing (6, Figure 5) and install a new compression spring (5, Figure 5).

25. PUCK ARM SLIP TORQUE ADJUSTMENT. As described in the Introduction section of these instructions and illustrated in Figure A, the rubber surfaced pucks should not begin to drive until they come into contact with the film reel flanges. As soon as this resistance is encountered, the slip torque between clutches should be overcome and the puck should begin to rotate. Normally, slip torque can be adjusted by means of the screw (1, Figure 7) which secures the clutch parts to the puck arm. Tightening this screw increases the slip torque; loosening the screw decreases the torque. With the projector operating in "reverse" mode, tighten the screw in the front puck arm clutch until the puck does not rotate; then back off the screw until the puck begins to spin. Repeat the adjustment at the rear puck arm with the projector operating in "forward." If unable to adjust torque as described, replace the clutch assembly (24, Figure 3) at the lower end of the puck arm.

Final Test

26. GENERAL INSTRUCTIONS.

This section contains the inspections and tests to be performed to check the operating condition of the projector before repairs are made and to verify the results of repairs and adjustments. When specific malfunctions are noted, refer to the following Trouble Shooting chart for probable causes and remedies. The projector is to be operated only from a 115 to 120 volt AC, 60-Hertz power source.

27. MECHANICAL INSPECTION PROCEDURES.

a. Pick up the projector, turn it over, and shake it to make certain that no loose parts are inside.

b. Check the front cover to make sure that it is secure in the closed position. Press the cover release latch and lift off the cover.

c. Use the film cutter (regular 8 or super 8 film) to make certain that it is cutting sharply and cleanly.

d. Remove the inner cover by pulling at the upper edge. Check to see that the cover latching fingers at the top and bottom are intact (not broken). Inspect the lamp for presence of dirt, fingerprints or burn spots. Clean or replace lamp as necessary.

e. Remove the puck cover by pulling on the upper edge until it snaps free. Check to see that the latching fingers (top and bottom) are intact (not broken). Inspect the rubber drive surface of the pucks for damage or unusual wear. If drive surface is dirty or oily, clean with methyl alcohol.

f. Remove the pressure shoe from the aperture area and place the projector on its rear end, lens bore facing up and lens removed. Shift the format lever several times between the R/8 and S/8 positions, checking to see that the masks snap freely into position without binding. Also check visually to see the masks are centered in the aperture.

g. Reinsert the pressure shoe and, while locking down into the lens bore, check for proper retraction of the pressure shoe by moving the control knob from FORWARD to REWIND and back again.

h. Set the projector on its feet and reinstall the lens. Check the operation of the focus knob. The knob must operate smoothly when moving the lens in and out.

i. Actuate the tilt lock lever to release the tilt foot. When the lever is released, the projector must remain in the raised position.

j. Remove the back cover (two screws at underside of bottom edge and two in cord retainer recess). Pull lightly on the power cord near the strain relief bushing to make certain that the bushing is secure. Check to make certain that all wires are properly retained by wire nuts and that wires are dressed out of the way.

k. Check the condition of the drive belt. If dirty or oily, clean with methyl alcohol. Move the control knob through all positions, checking the action of the various gears and levers. A description of gear and lever operation will be found in the Introduction section of these instructions.

28. GENERAL OPERATING TEST.

a. Connect the projector power cord to a 115 to 120 volt AC, 60 Hertz power source and install an empty reel on the take-up spindle. Place the projector on a stand or work bench seven feet from a projection screen.

b. Place the main switch in the LAMP position, the control knob in FORWARD mode, and the format lever in the S8 (super 8) position. Feed the strip of test film (TF-68 with 18-inch leader) into the upper film guide until the film is picked up by the shuttle. The shuttle must drive the film through the film path and the film must be taken up by the reel. If shuttle does not advance film, refer to paragraph 30, following. While the projector is running, listen for any unusual noises not related to normal projector operation.

c. Run the projector in FORWARD and REVERSE and observe the picture on the screen. The test film image must be clear and steady and no vertical or horizontal movement should be noticeable in either extreme framing position.

d. Design 1623 Only. Repeat step (c) at all three speeds: normal (18 fps), slow motion (6 fps) and "step" mode (2 fps).

e. Place a fully-loaded 400-foot reel on the supply spindle and, with the control knob in the FORWARD mode, thread the film through the projector and onto the take-up reel. Run approximately 25 to 30 feet of film through the projector while checking the supply reel for film spilling. If spilling occurs, refer to paragraph 24 for spindle torque adjustment.

f. After running 25 to 30 feet of film through the projector, set the control knob at REWIND and check to see that the front puck positively drives the almost-fully loaded front reel. Puck torque is adjusted as instructed in paragraph 25. Rewind the film back onto the supply reel and place the control knob in the STILL position.

g. Tape the end of the film leader so that the film will not spill from the reel and place the fully-loaded reel on the take-up spindle. Set the control knob in the FORWARD position and check to see that the rear puck positively drives the reel. Puck torque is adjusted as instructed in paragraph 25.

h. Remove the lens and focus the apertures on the screen. Check the illuminated area for shadowed areas, especially along the vertical sides, while moving the framing lever up and down. Shadowed areas indicate touching lamp element coils and the lamp should be replaced.

i. With the aperture still focused on the screen, move the control knob through the FORWARD, STILL and REVERSE positions several times to make certain that the fire shutter is operating freely. The fire shutter heat filter should completely cover the aperture opening with the control knob in STILL.

29. CHECKING APERTURE FRAMING. When checking aperture framing, use TF-47 test film for regular-8 projection and TF-68 test film for super-8.

a. Place the format shifting lever in the S8 (super-8) position and the main switch in the LAMP position.

b. Set the control knob at FORWARD and feed the super-8 test film (TF-68) into the upper film guide until film is picked up by the shuttle.

c. Focus the test film target on the screen and check the framing with the framing lever in both extremes (fully up and fully down). Premissible framing limits are shown in View A of Figure H. Run projector in REVERSE and again check framing.

d. Run out the test film and stop the projector. Place the format shifting lever in the R8 (regular-8) position and again start the projector in FORWARD, this time threading the regular-8 test film (TF-47) into the projector. Permissible framing limits for regular-8 film are shown in View B of Figure H.

e. Horizontal (side to side) framing within the aperture opening can be adjusted as outlined in paragraph 21. If the projector is out-of-frame vertically, it may be necessary to shift the aperture plate slightly to correct the condition; then readjust the horizontal framing as instructed in paragraph 21.

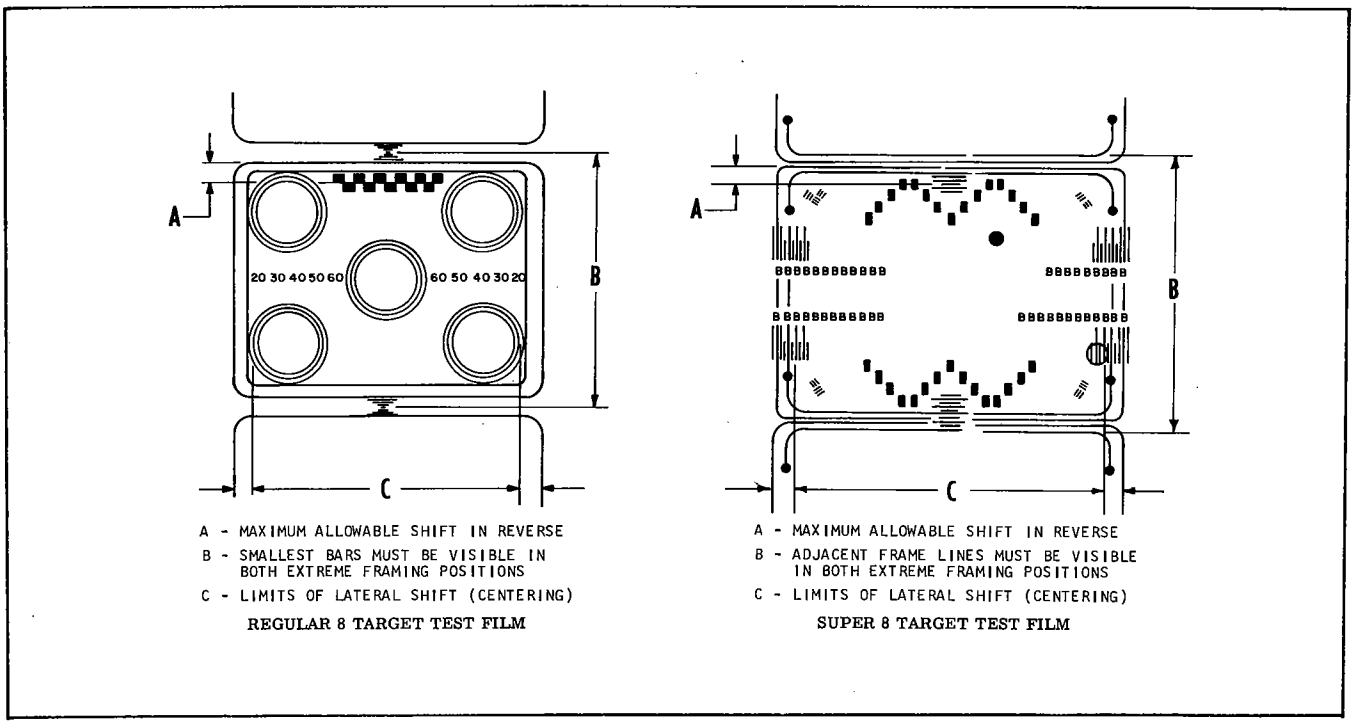


Figure H. Film Framing Check

30. CHECKING SHUTTLE TOOTH CENTERING AND PROTRUSION. Shuttle tooth centering is checked visually with the aid of a magnifying glass. Use the shuttle protrusion gage (G-9991-N1) to check for proper protrusion of the shuttle teeth. The back cover, the control cover, the lower film guide assembly and the face tension lever assembly must be removed from the projector in order to check the shuttle teeth.

a. Place the format shift lever in the S8 (super-8) position and remove the pressure shoe. Set the projector on the work bench with the lens bore facing up and lay a strip of super-8 film leader in the film channel.

b. With the control knob in FORWARD, rotate the motor pulley clockwise to advance the shuttle to the top of the stroke, teeth protruding through the film perforations. Inspect tooth centering through the magnifying glass while slowly advancing the shuttle to the bottom of the stroke. If shuttle teeth are out-of-center, refer to paragraph 22 for adjustment.

c. Remove the test film strip and once again advance the shuttle teeth to the top of the stroke, with teeth at maximum protrusion. Place the shuttle protrusion gage in the film channel, "GO" end (0.036 inch) up. While holding the gage lightly against the fixed guide rail, slide the gage up toward the shuttle teeth. The "GO" end of the gage should clear the teeth.

d. Repeat the check with the "NO-GO" end of the gage (0.030 inch) up. This time the gage should catch against the lower shuttle tooth. Manually advance the shuttle with the motor pulley. The shuttle tooth should push the gage all the way down to the bottom of the stroke.

e. If shuttle tooth protrusion does not fall within the limits of the gage (0.030 to 0.036 inch), refer to paragraph 22 for adjustment.

Trouble Shooting

TROUBLE	PROBABLE CAUSE	REMEDY
Projector inoperative with switch in the MOTOR or LAMP position	1. No electrical power.	1. Check power source.
	2. Broken drive belt.	2. Replace belt.
	3. Defective motor.	3. Replace motor.
	4. Defective switch or wiring.	4. Check switch and circuitry.
Picture flicker	1. Drive pucks driving erratically (grease on rubber rim or improper clutch torque).	1. Clean rims with methyl alcohol; adjust torque (paragraph 25).
	2. Drive belt slipping (grease).	2. Clean belt and pulleys with methyl alcohol.
	3. Defective drive belt pulley.	3. Replace drive belt pulley.
	4. Dirt, wear or binding in gearing.	4. Clean and repair or adjust gearing.
Film scratches	1. Excessively dirty film channel parts (rollers, guides, etc.).	1. Clean projector thoroughly.
	2. Worn aperture plate or pressure shoe.	2. Replace worn or marred parts.
	3. Worn or damaged aperture plate film guide rail.	3. Replace aperture plate.
Jumpy picture	1. Torn film perforations.	1. Inspect and splice film as necessary.
	2. Green film.	2. Run film through projector two or three times to age the film.

TROUBLE	PROBABLE CAUSE	REMEDY
Jumpy picture (Cont'd)	3. Shuttle tooth worn.	3. Replace shuttle assembly.
	4. Misaligned shuttle tooth.	4. Adjust and align shuttle as instructed in paragraph 22.
	5. Grooves worn in aperture plate film guide rail.	5. Replace aperture plate.
	6. Lower loopformer binding.	6. Free up binding loopformer.
Soft focus	1. Dirty projection lens.	1. Clean projection lens.
	2. Faulty lens.	2. Replace lens.
Film spills	1. Insufficient tension on take-up spindle.	1. Adjust tension (paragraph 24).
Fails to take-up or rewind	1. Defective drive belt.	1. Replace belt.
	2. Worn rim on drive puck.	2. Replace worn drive puck.
	3. Drive puck torque not adjusted properly.	3. Readjust as instructed in paragraph 25.
	4. Defective reel spindle.	4. Replace spindle.
Noisy	1. Loose attaching parts.	1. Tighten as necessary.
	2. Gearing dry.	2. Lubricate as necessary.
Dim projected pictures	1. Projector lamp dirty.	1. Clean projector lamp.
	2. Wrong lamp used.	2. Use proper lamp (Type DLE) for 1620 and Type DLD for 1623 projector.
	3. Dirty heat filter glass in fire shutter.	3. Clean heat filter glass with mild detergent.
Pictures not framing properly	1. Framing eccentrics out-of-adjustment (horizontal).	1. Adjust framing (paragraph 21).
	2. Aperture plate out-of-line.	2. Reposition aperture plate.
Film transport problems	1. Incorrect shuttle tooth penetration or centering.	1. Adjust as instructed in paragraph 22.
	2. Cam shoes too tight or too loose.	2. Correct shoe fit by slecting proper cam shoes (21, Figure 9).
	3. Gears improperly timed.	3. Retime gears as shown in Figure D.
	4. Bent shuttle.	4. Straighten or replace bent shuttle.
Speed change failure (Design 1623)	1. Cam follower screw missing or broken.	1. Replace cam follower screw (58A, Figure 9).
	2. Multi-motion linkage loose or out-of-adjustment.	2. Adjust per paragraph 23.
	3. Gearing out-of-time.	3. Retime gears as shown in Figure D.

SUPPLEMENT NO. 1

COMPATIBLE 8MM-SUPER 8MM AUTOLOAD® PROJECTOR

DESIGN 1625B

NOTE: THIS SUPPLEMENT IS TO BE USED TOGETHER WITH BASIC SERVICE MANUAL PART NO. 72797 (REVISED APRIL 1974) FOR REPAIRING AND ADJUSTING THE DESIGN 1625B AUTOLOAD PROJECTOR.

CONSUMER PRODUCTS GROUP

BELL & HOWELL

GENERAL SERVICE DEPT.
7100 McCORMICK ROAD
CHICAGO, ILLINOIS 60645

SUPPLEMENT NO. 1
PART NO. 72797

PRINTED IN U.S.A.

JANUARY 1975

SUPPLEMENTAL DATA FOR
SERVICE MANUAL NO. 72797

GENERAL.

This Supplement has been prepared to up-date the information contained in Service Manual No. 72797 (Revised April 1974) and to provide the additional data necessary for the repair of the Design 1625B Autoload Movie Projector.

The Design 1625B projector is equipped with a room lamp receptacle mounted in the rear cover and wired as shown in Figure A of this Supplement. Except for this difference, the Design 1625B projector is identical to the Design 1625A, and repair procedures for the latter will apply to both models. In the Parts Catalog section, all uncoded parts (Usable on Code column blank) and parts coded "E" (Design 1625A parts) will apply to the Design 1625B except as noted in the following paragraphs.

FIGURE 1 CHANGES AND DIFFERENCES.

Item 1-13B, Trimplate: Add letter "E" to the code column to indicate that this trimplate is also used in Design 1625 projectors.

Item 1-18, Eyelet: This part has been eliminated from all current production models.

Item 1-19, Back Cover Assembly: For Design 1625B projectors, order P/N 015684.

Item 1-20, Grommet: This part has been eliminated from all current production models.

Items 1-22 and 1-23, Top and Side Seals: These parts have been eliminated from all current production models.

Item 1-25, Retainer Clip: Clip P/N 46192 has been discontinued and is replaced by P/N 39109 (all except export models).

NOTE: In Design 1625B projectors, a room lamp receptacle P/N 45917 is mounted in the back cover and held in place with a rectangular retainer P/N 45898. Wiring connections for the receptacle are shown in Figure A of this Supplement. Remaining wiring connections are the same as those shown in Figure 10 of the basic Parts Catalog.

FIGURE 2 CHANGES AND DIFFERENCES.

Item 2-1 Setscrew (Second Listing): Setscrew P/N 80591 has been replaced by P/N 12498, which is a 6-32NC by 1/8 inch long setscrew. Note A, regarding early and current puck assemblies and their setscrews, still applies.

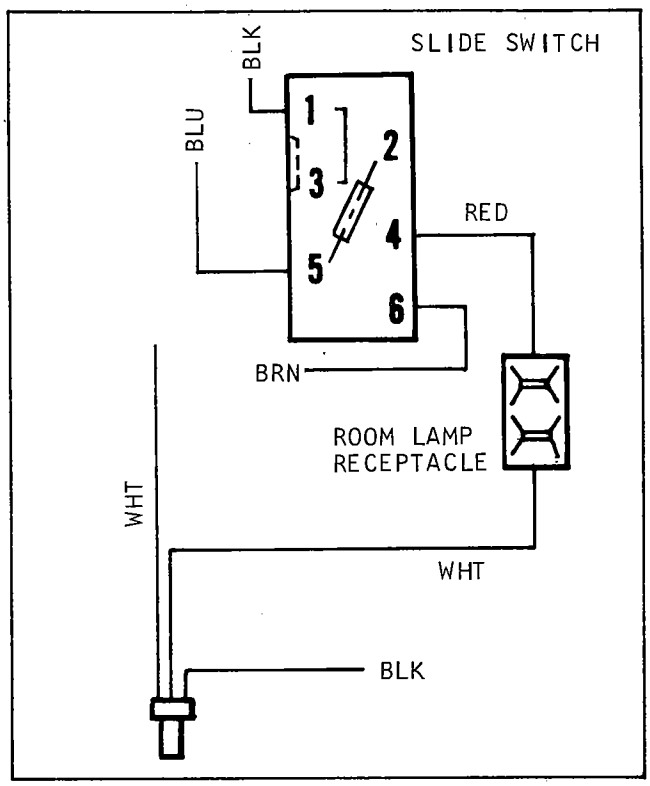


Figure A. Room Lamp Receptacle Wiring Connections

Items 2-2 and 2-3, Puck and Sleeve Assemblies: Design 1625B projectors use only the current model parts.

Item 2-9, Multi-Motion Link: Link P/N 46045 has been discontinued and is replaced by P/N 48828 (all multi-motion models).

Item 2-19, Main Switch Assembly: Design 1625B projectors use main switch P/N 015667.

FIGURE 3 CHANGES AND DIFFERENCES.

Items 3-8 and 3-9, Setscrew and Gear: In all current model projectors, helical P/N 45805 has been superseded by gear P/N 47745, which is secured with setscrew P/N 80591 (6-32NC by 3/16 inch long). If this gear requires replacement, use the current gear and setscrew.

Items 3-31 and 3-32, Setscrew and Gear: In all current model projectors, helical gear P/N 45805 has been superseded by gear P/N 47745, which is

secured with setscrew P/N 80591 (6-32NC by 3/16 inch long). If this gear requires replacement, use the current gear and setscrew.

Items 3-40A and 3-40B, Shim Washers: Delete all code letters from the Usable on Code column. These shim washers are used on all projector models.

Item 3-41 (Second Listing), Gear: Crown gear P/N 46948 has been discontinued. Delete all code letters from the Usable on Code column for crown gear P/N 45880 (first listing) to indicate that this gear is used on all projector models.

Items 3-45 and 3-45A, Shim Washers: Delete all code letters from the Usable on Code column. These shim washers are used on all projector models.

Item 3-46, Crown Gear: Crown gear P/N 45879 (first listing) is now used in all projector models and crown gear P/N 46947 (second listing) has been discontinued.

Item 3-47, Reverse Lever Assembly: Lever assembly P/N 014849 (first listing) is now used on all projector models and lever assembly P/N 014841 (second listing) has been discontinued.

NOTE: In Figure 3, the inset showing the retaining ring (45B) and crown gear (46) is identified incorrectly as being used in the Design 1625 projectors. Change this to "Design 1615." Also, Figure 3 does not show the tension spring P/N 46968 assembled between the control stop (2) and the tilt shaft guide bracket (4) on all projectors. This spring and the manner in which it is assembled is shown in Figure B of this Supplement.

FIGURE 4 CHANGES AND DIFFERENCES.

Item 4-11, Screw: Screw P/N 700454 has been superseded by screw P/N 45721 on all models.

Item 4-28, Data Plate: This data plate is affixed to the underside of the base and is represented in Figure 4 by a dash-line rectangle above and to the right of the motor mounting screw (item 4-11).

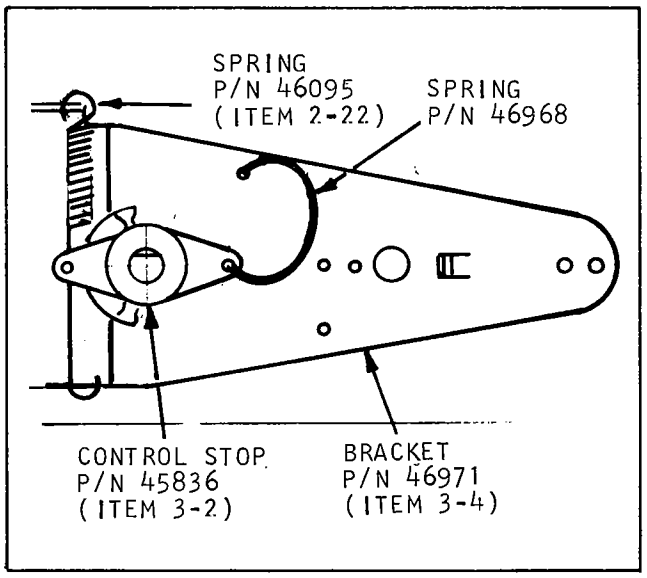


Figure B. Control Stop Tension Spring

FIGURES 5A AND 5B. Design 1625B projectors were never manufactured with the "early" upper film guide parts illustrated in Figure 5A. Use Figure 5B when repairing Design 1625B projectors.

FIGURES 6 AND 7. All Figure 6 and 7 parts are applicable to Design 1625B projectors.

FIGURES 8 AND 9. All uncoded and code "E" parts in Figures 8 and 9 are applicable to Design 1625B projectors. Note, in Figure 8, that an adhesive-backed trimplate P/N 46957 is secured to the face of the focus knob (item 8-17) on all projector models.

FIGURE 10. Except for the addition of the room lamp receptacle, wired as shown in Figure A of this Supplement, the Design 1625B wiring connections are the same as those shown in the "Model A Suffix" diagrams of Figure 10.

PARTS CATALOG

COMPATIBLE 8MM-SUPER 8MM AUTOLOAD® PROJECTOR

DESIGNS 1620 & 1623

CONSUMER PRODUCTS GROUP

BELL & HOWELL

GENERAL SERVICE DEPT.
7100 McCORMICK ROAD
CHICAGO, ILLINOIS 60645

PART NO. 72797-1 PRINTED IN U.S.A. JULY 1973

Replacement Parts

The following pages illustrate and list, by part number and description, all replacement parts for Bell & Howell Compatible Super 8/Regular 8 Movie Projectors, Design 1620 and 1623. When ordering replacement parts, be sure to check the Usable on Code column to make certain that the part in question is applicable to the projector being repaired. If the column is blank, the part is usable on all projectors. Code letter "A" indicates that the part is usable only on the Design 1620 and code letter "B" indicates that the part is used only on the Design 1623. Following is a listing of available accessories.

ACCESSORY ITEMS

Lens, Projection, 1-inch f/1.6 . . . . P/N 022700
Lens, Zoom, 19.3-35 mm f/1.2 . . . . P/N 020567
Lens, Zoom, 18-30 mm f/1.6 . . . . . P/N 204136
Reel, Take-up, 400 ft . . . . . P/N 014855
Can, Reel Storage . . . . . P/N 12104

FIG. & INDEX NO.	PART NO.	DESCRIPTION 1 2 3 4 5 6 7	UNITS PER ASSY	USABLE ON CODE
		FILM GUIDES, MAIN FRAME AND MAIN PLATE		
2-1	29192	SETSCREW, Fluted socket cup pt, 4-40 by 1/8 inch	2	
-2	015203	PUCK AND SLEEVE ASSEMBLY, L.H.	1	
-3	014401	PUCK AND SLEEVE ASSEMBLY, R.H.	1	
-3A	44092	. TRIM DISC, Puck (cement in place)	1	
-4	80591	SETSCREW, Fluted socket cup pt, 6-32 by 3/16 inch	2	B
-5	45956	SHAFT, Multi-motion	1	B
-6	45806	KNOB, Multi-motion	1	B
-7	765449	RING, Retaining, external, 0.188 inch	1	B
-8	45825	ARM, Link	1	B
-9	46045	LINK, Multi-motion	1	B
-10	46124	SCREW, Hex head self tapping, 6-20	7	
-11	014842	FILM GUIDE ASSEMBLY, Upper (see Figure 5 for detail parts)	1	
-12	46097	DECAL, "Load Film Here" (adhesive backed)	1	
-13	46109	SCREW, Fillister head self tapping, 6-32	2	
-14	46198	SCREW, Fillister head self tapping, 6-32	3	
-15	43857	WASHER, Flat	1	
-16	34590	SCREW, Flat head, 6-32 by 3/8 inch	2	
-17	014843	FILM GUIDE ASSEMBLY, Lower (see Figure 6 for detail parts)	1	
-18	46116	LABEL, Lamp type (adhesive backed)	1	A
-18	46115	LABEL, Lamp type (adhesive backed)	1	B
-19	014845	SWITCH ASSEMBLY, Main	1	
-19A	39182	. SLEEVE, Insulating	1	
-19B	45874	. SHIELD, Switch	1	
-20	21736	RING, Retaining, 0.207 inch ID	1	
-21	015279	TILT ASSEMBLY, Projector	1	
-21A	45560	. FOOT, Rubber	2	
-22	46095	SPRING, Extension	1	
-23	46018	BRACKET, Tilt lock	1	
-24	30809	SCREW, Hex head swage type, 6-32 by 3/8 inch	6	
-25	No Number	MAIN PLATE ASSEMBLY (See Figure 3 for detail parts)	NP	
-26	No Number	MAIN FRAME AND BLOWER ASSEMBLY (See Figure 4 for detail parts)	NP	

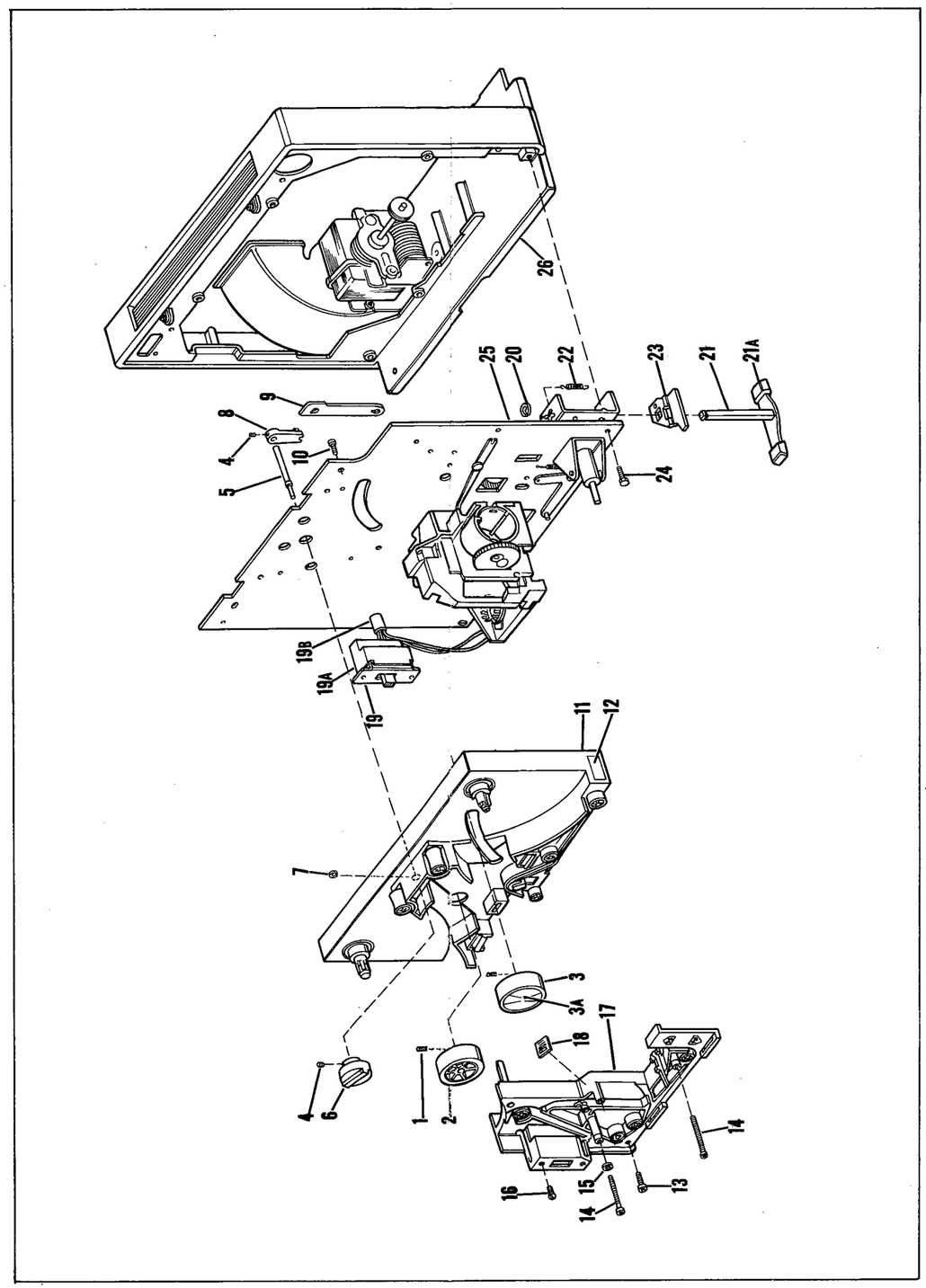


Figure 2. Film Guides, Main Frame and Main Plate

FIG. & INDEX NO.	PART NO.	DESCRIPTION 1 2 3 4 5 6 7	UNITS PER ASSY	USABLE ON CODE
		COVERS AND LAMP		
1-1	015275	COVER ASSEMBLY, Front, complete	1	A
-1	015276	COVER ASSEMBLY, Front, complete	1	B
-2	46150	. NAMEPLATE, Model No. (adhesive backed)	1	A
-2	46187	. NAMEPLATE, Model No. (adhesive backed)	1	B
-3	46098	. LABEL, Instruction (adhesive backed)	1	A
-3	46099	. LABEL, Instruction (adhesive backed)	1	B
-4	46182	. RIVET, Semi-tubular	1	
-5	45944	. SPACER, Latch	1	
-6	46056	. SPRING, Latch	1	
-7	45821	. LATCH, Front cover	1	
-8	46987	. RIVET, Semi-tubular	2	
-9	40498	. GUIDE, Film cutter	1	
-10	40497	. CUTTER, Film	1	
-12	No Number	. COVER, Front (replace cover assembly, complete)	NP	
-13	015277	COVER ASSEMBLY, Inner	1	A
-13	015278	COVER ASSEMBLY, Inner	1	B
-13A	45919	. NAMEPLATE, Model No. (adhesive backed)	1	A
-13A	45920	. NAMEPLATE, Model No. (adhesive backed)	1	B
-14	46117	LAMP, Projection, Type DLE	1	A
-14	46158	LAMP, Projection, Type DLD	1	B
-15	45842	COVER, Puck	1	A
-15	015297	COVER ASSEMBLY, Puck	1	B
-15A	46123	. NAMEPLATE, Norm/Slow/Step (adhesive backed)	1	B
-16	766221	SCREW, Hex washer head, 6-32 by 3/8 inch	2	
-17	766221	SCREW, Hex washer head, 6-32 by 3/8 inch	2	
-18	46908	EYELET, Metal	4	
-19	015281	COVER ASSEMBLY, Back, complete	1	
-20	46907	. GROMMET, Rubber	4	
-21	46142	. PAD, Blower opening (adhesive backed)	1	
-22	46909	. SEAL, Top (cement in place)	1	
-23	46910	. SEAL, Side (cement in place)	1	
-24	766324	. SLEEVE, Insulating	1	
-25	46192	. CLIP, Reel retainer	1	
-26	22464	. BUSHING, Strain relief	1	
-27	No Number	. COVER AND CORD RETAINER ASSEMBLY (Replace cover assembly, complete)	NP	
-28	39181	CORD, Line	1	
-29	46159	CLIP, Canoe	1	
-30	766174	SCREW, Slotted hex head, 4-24	4	
-31	015298	COVER ASSEMBLY, Control	1	
-31A	45921	. NAMEPLATE, Control (adhesive backed)	1	

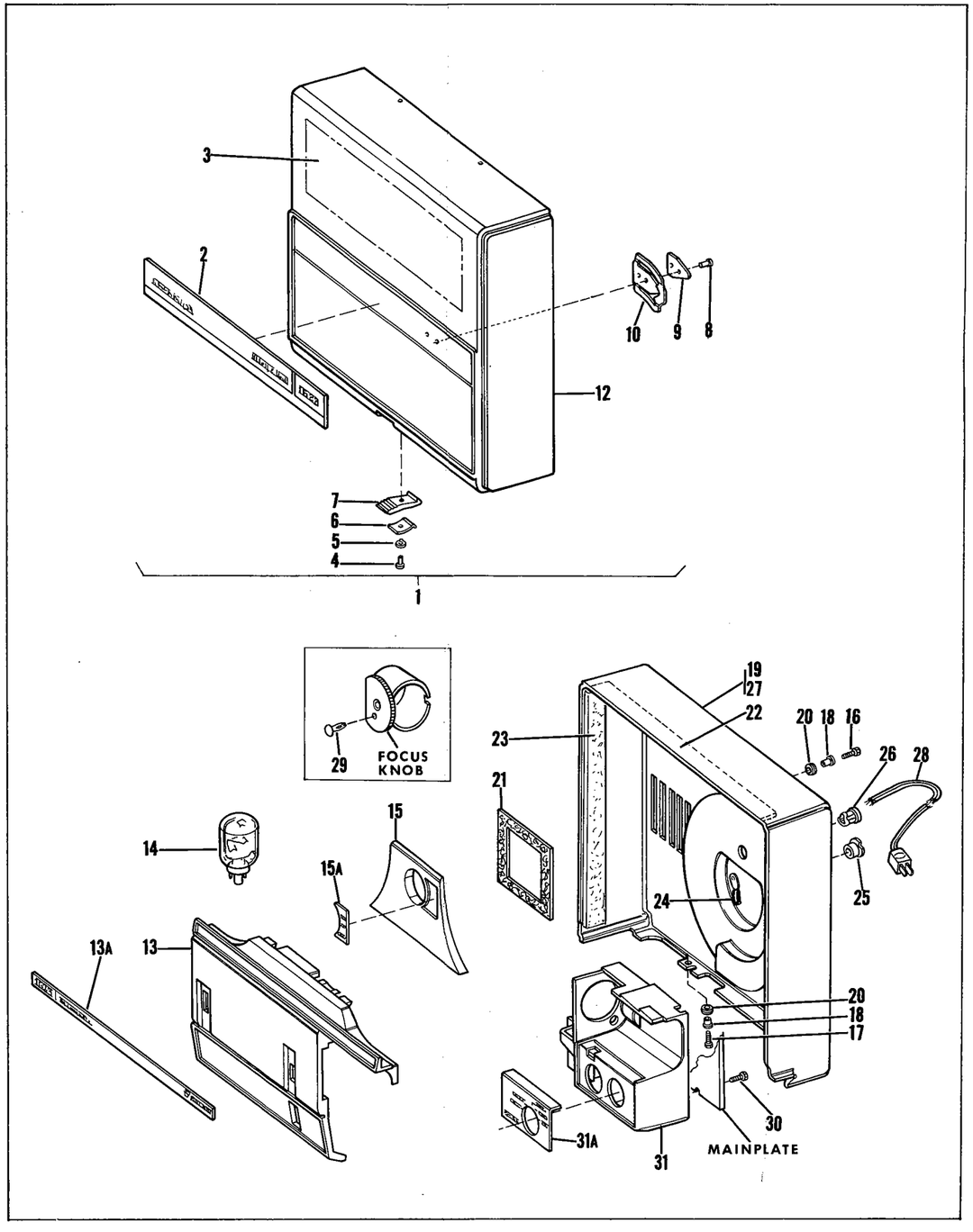


Figure 1. Covers and Lamp

FIG. & INDEX NO.	PART NO.	1 2 3 4 5 6 7 DESCRIPTION	UNITS PER ASSY	USABLE ON CODE
		MAIN PLATE COMPONENTS		
3-1	80591	SETSCREW, Fluted socket cup pt, 6-32 by 3/16 inch	1	
-2	45836	STOP, Control	1	
-3	765449	RING, Retaining, external, 0.188 inch	1	
-4	46019	BRACKET, Tilt shaft guide	1	
-5	12498	SETSCREW, Fluted socket cup pt, 6-32 by 1/8 inch	1	
-6	32974	SETSCREW, Fluted socket cup pt, 8-32 by 1/8 inch	1	
-7	45970	SHAFT, Forward/Reverse	1	
-8	12498	SETSCREW, Fluted socket cup pt, 6-32 by 1/8 inch	1	
-9	45805	GEAR, Helical	1	
-10	33966	RING, Retaining, external, 0.219 inch ID (E)	1	
-11	015205	BRACKET AND BUSHING ASSEMBLY	1	
-12	42154	NUT, Hex	1	
-13	36838	SCREW, Pan head, 4-40 by 3/8 inch	1	
-14	36837	SCREW, Pan head, 4-40 by 1/4 inch	1	
-15	46030	BRACKET, Support	1	
-16	46108	SPRING, Extension	2	
-17	765449	RING, Retaining, external, 0.188 inch	1	
-18	17639	RING, Retaining, external, 0.125 inch ID (E)	1	
-19	015204	BRACKET AND STUD ASSEMBLY, Slide	1	
-20	765449	RING, Retaining, external, 0.188 inch	1	
-21	46071	LEVER, Still	1	
-22	46177	SPRING, Extension	1	
-23	17639	RING, Retaining, external, 0.125 inch ID (E)	2	
-24	014834	CLUTCH ASSEMBLY	2	
-25	30809	SCREW, Swage type, 6-32 by 3/8 inch (early models only)	4	
-26	34874	WASHER, Flat (early models only)	4	
-27	45804	GUIDE, Puck arm (early models only)	2	
-28	33966	RING, Retaining, external, 0.219 inch ID (E)	2	
-29	014833	PUCK ARM ASSEMBLY (See Figure 7 for parts)	2	
-30	46135	SPRING, Extension	1	
-31	12498	SETSCREW, Fluted socket cup pt, 6-32 by 1/8 inch	1	
-32	45805	GEAR, Helical	1	
-33	80591	SETSCREW, Fluted socket cup pt, 6-32 by 3/16 inch	1	
-34	015294	CAM AND SPRING ASSEMBLY, Control	1	
-35	45959	SHAFT, Control	1	
-36	80591	SETSCREW, Fluted socket cup pt, 6-32 by 3/16 inch	1	
-37	45856	KNOB, Control	1	
-38	45854	BUTTON, Detent	2	
-39	17676	RING, Retaining, external Type E, 0.156 inch ID	1	
-40	014840	GEAR SUPPORT ASSEMBLY, R.H.	1	
-41	45880	GEAR, Crown, black	1	
-42	46144	SPRING, Trigger	1	
-43	17676	RING, Retaining, external Type E, 0.156 inch ID	1	
-44	014839	GEAR SUPPORT ASSEMBLY, L.H.	1	
-45	34878	WASHER, Shim	3	
-46	45879	GEAR, Crown, white	1	
-47	014849	LEVER ASSEMBLY, Reverse	1	
-48	30809	SCREW, Swage type, 6-32 by 3/8 inch hex washer head	1	
-49	26906	NUT, Hex	2	
-50	46168	SCREW, Special	3	
-51	46921	SPACER, Sleeve	1	
-52	014830	MODULE ASSEMBLY, Mechanism, complete (see Figure 8 for replacement parts)	1	
-52	014850	MODULE ASSEMBLY, Mechanism, complete (see Figure 8 for replacement parts)	1	
-53	766183	NUT, Square	1	
-54	12498	SETSCREW, Fluted socket cup pt, 6-32 by 1/8 inch	2	
-55	45882	GEAR, Helical, black	1	
-56	45881	GEAR, Helical, white	1	
-57	014832	MAIN PLATE AND STUD ASSEMBLY	1	

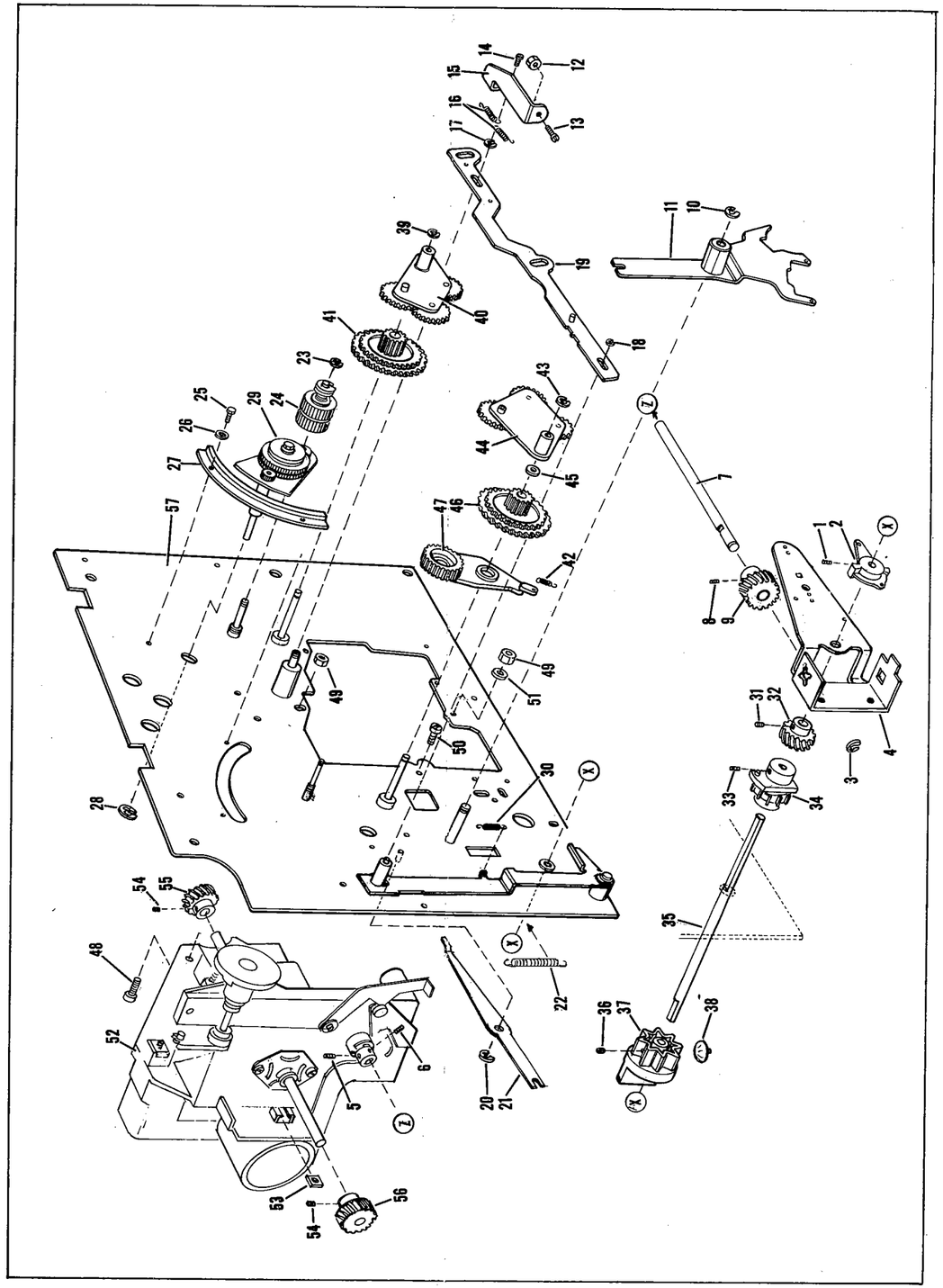


Figure 3. Main Plate Components

FIG. & INDEX NO.	PART NO.	DESCRIPTION 1 2 3 4 5 6 7	UNITS PER ASSY	USABLE ON CODE
		MAIN FRAME AND BLOWER ASSEMBLY		
4-1	45972	PIN, Locator, front cover	2	
-2	45847	GROMMET, Rubber	2	
-3	45839	RETAINER, Handle	2	
-4	46598	INSERT, Handle retainer	2	
-5	46133	HANDLE, Carrying	1	
-6	80591	SETSCREW, Fluted socket cup pt, 6-32 by 3/16 inch	1	
-7	45965	PULLEY, Motor	1	
-8	80947	SCREW, Round head Sems, 6-32 by 3/16 inch	1	
-9	31585	TIE, Wire	1	
-10	766324	SLEEVE, Insulating	2	
-11	700454	SCREW, Pan head Sems, 6-32 by 3/8 inch	4	
-12	014844	MOTOR ASSEMBLY, Blower, complete	1	
-13	766174	. SCREW, Slotted hex head, 4-24	5	
-14	46068	. COVER, Blower	1	
-16	46139	. FAN, Blower	1	
-17	19535	. SCREW, Phillips pan head tapping, 6-20 by 3/8 inch	2	
-18	31585	. TIE, Wire	1	
-19	45837	. HOUSING, Blower	1	
-20	46107	. DEFLECTOR, Air (cement in place)	1	
-21	26906	. NUT, Hex	4	
-22	39256	. SCREW, Round head, 6-32 by 1-7/8 inch	4	
-23	46067	. BRACKET, Motor mounting	2	
-24	45968	. SPACER, Grommet	4	
-25	45429	. GROMMET, Rubber	4	
-26	014836	. MOTOR ASSEMBLY	1	
-27	015280	MAIN FRAME ASSEMBLY, Complete	1	
-27A	32652	. RIVET, Tubular, 0.123 inch diameter by 3/8 inch	1	
-27B	39776	. RIVET, Semi-tubular, 0.123 inch diameter	1	
-27C	45561	. FOOT, Rubber	2	
-27D	No Number	. FRAME AND BRACKET ASSEMBLY (Order complete main frame assembly)	NP	
-28	46184	PLATE, Data (adhesive backed)	1	A
-28	46185	PLATE, Data (adhesive backed)	1	B

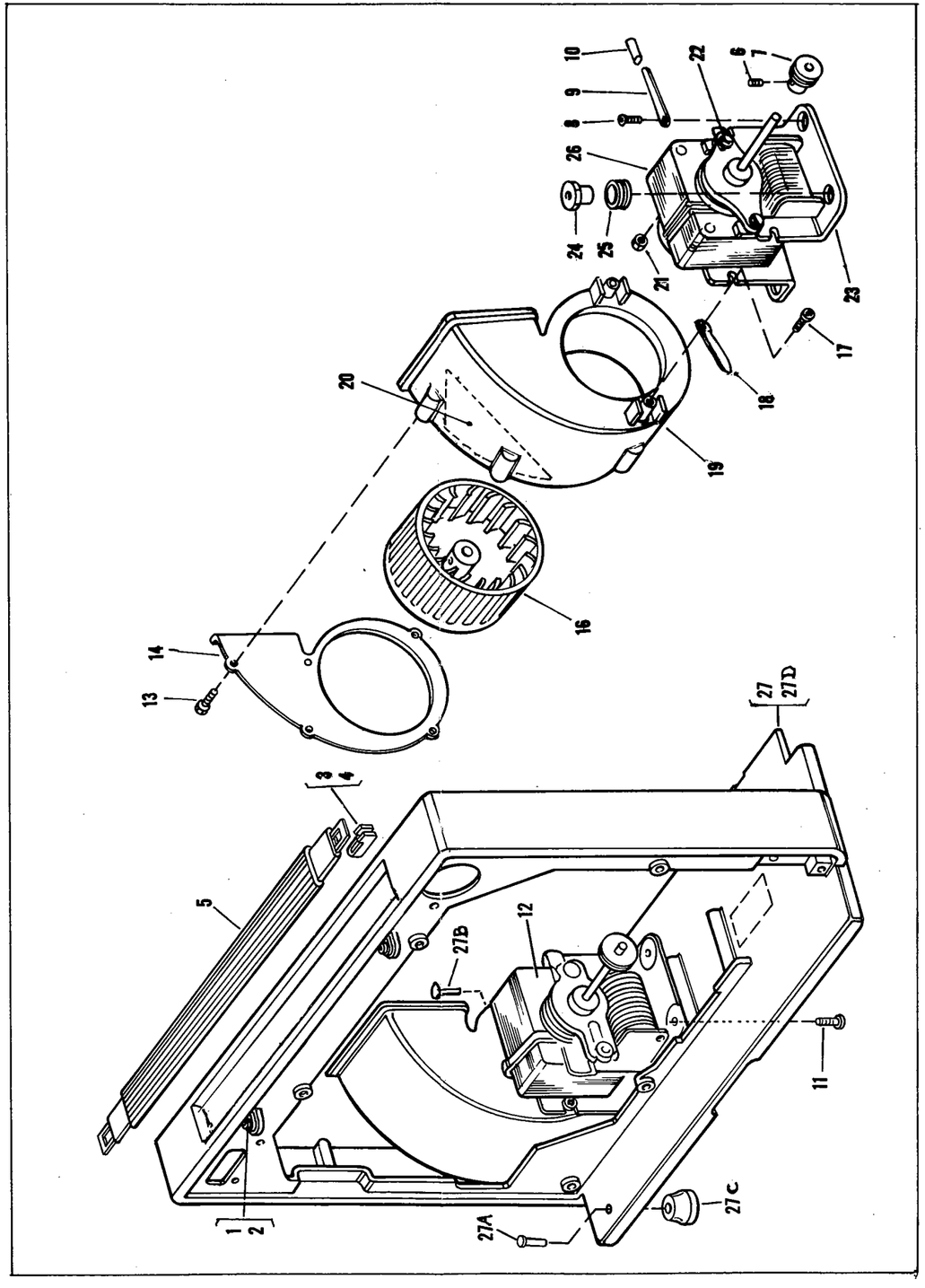


Figure 4. Main Frame and Blower Assembly

FIG. & INDEX NO.	PART NO.	DESCRIPTION 1 2 3 4 5 6 7	UNITS PER ASSY	USABLE ON CODE
		UPPER FILM GUIDE ASSEMBLY		
5-	014842	FILM GUIDE ASSEMBLY, Upper	REF	
-1	45977	. SCREW, End cap	1	
-2	46980	. WASHER, Flat	1	
-3	45859	. SPINDLE, Standard 8-mm	1	
-4	45855	. ADAPTER, Super 8-mm	1	
-5	~~45997~~ 47734	. SPRING, Compression	1	
-6	45884	. BUSHING, Friction	1	
-7	45998	. WASHER, Flat	1	
-8	46147	. RING, Retaining, push-on	1	
-9	24153	. WASHER, Flat	1	
-10	015293	. SHIELD AND POST ASSEMBLY, Puck	1	
-11	46106	. SPRING, Torsion	1	
-12	46178	. PAD, Puck bumper (adhesive backed)	2	
-13	29694	. RING, Retaining, push-on	1	
-14	45834	. ARM, Trip	1	
-15	46015	. SPRING, Tension	1	
-16	46160	. SLEEVE, Snubber pin	1	
-17	46147	. RING, Retaining, push-on	5	
-18	46146	. WASHER, Flat	5	
-19	45964	. ROLLER, Film guide, 5/16 inch long (early models)	2	
-19A	46989	. HALF ROLLER, Film guide (current models)	2	
-19B	46990	. HALF ROLLER, Film guide (current models)	2	
-20	45986	. ROLLER, Film guide, metal	1	
-21	45973	. ROLLER, Film guide, 1/2 inch long	2	
-22	015296	. FILM GUIDE AND SNUBBER ASSEMBLY	1	

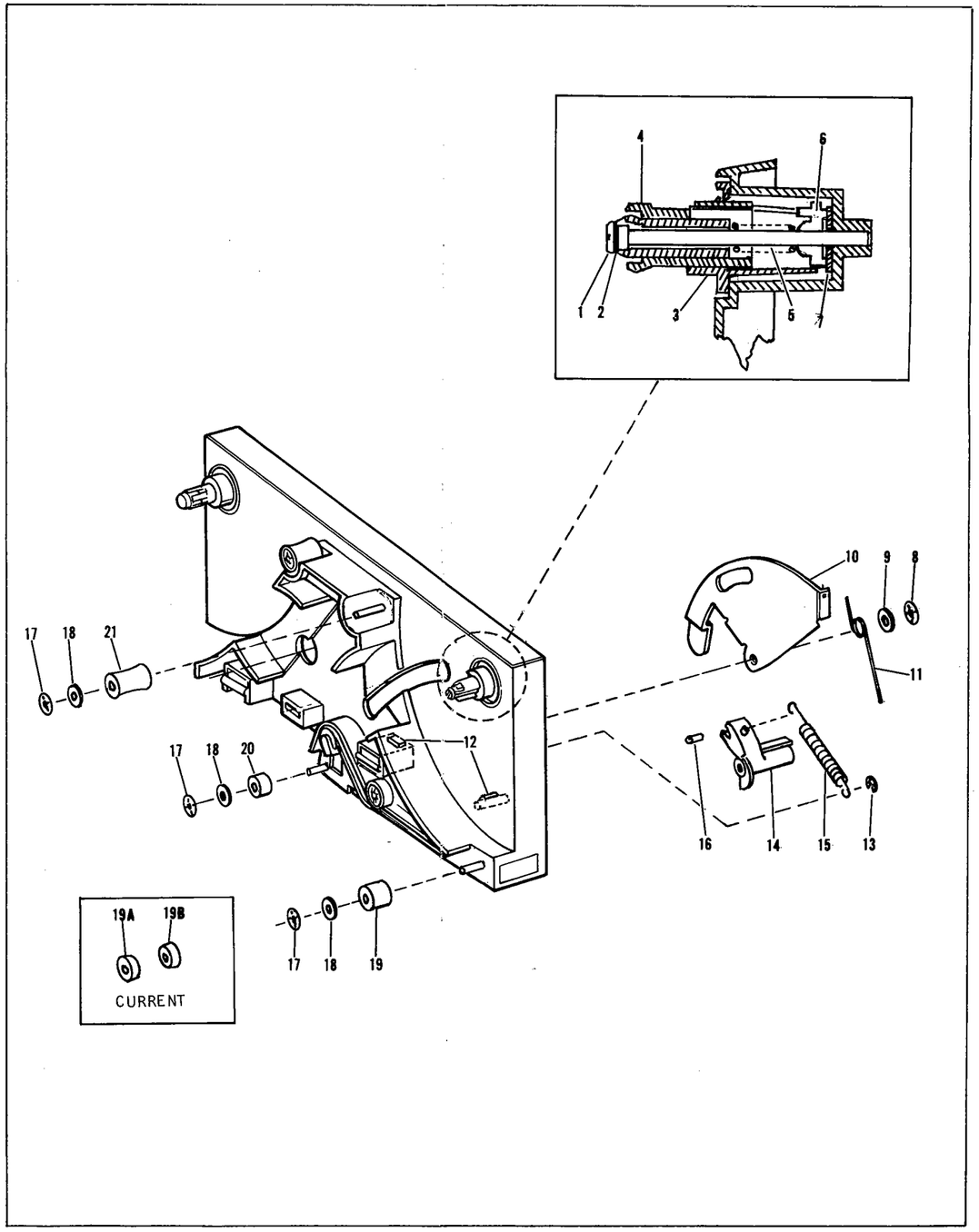


Figure 5. Upper Film Guide Assembly

FIG. & INDEX NO.	PART NO.	DESCRIPTION 1 2 3 4 5 6 7	UNITS PER ASSY	USABLE ON CODE
		LOWER FILM GUIDE ASSEMBLY		
6-	014843	FILM GUIDE ASSEMBLY, Lower	REF	
-1	46741	. EJECTOR, Lamp	1	
-2	46013	. SPRING, Flat	1	
-3	46147	. RING, Retaining, push-on	4	
-4	46146	. WASHER, Flat	4	
-5	45964	. ROLLER, Film guide (early models)	4	
-5A	46989	. HALF ROLLER, Film guide (current models)	4	
-5B	46990	. HALF ROLLER, Film guide (current models)	4	
-6	46944	. SNUBBER, Rear	1	
-7	46943	. FILM GUIDE, Lower	1	
-8	46014	. PAD, Friction (adhesive backed)	1	

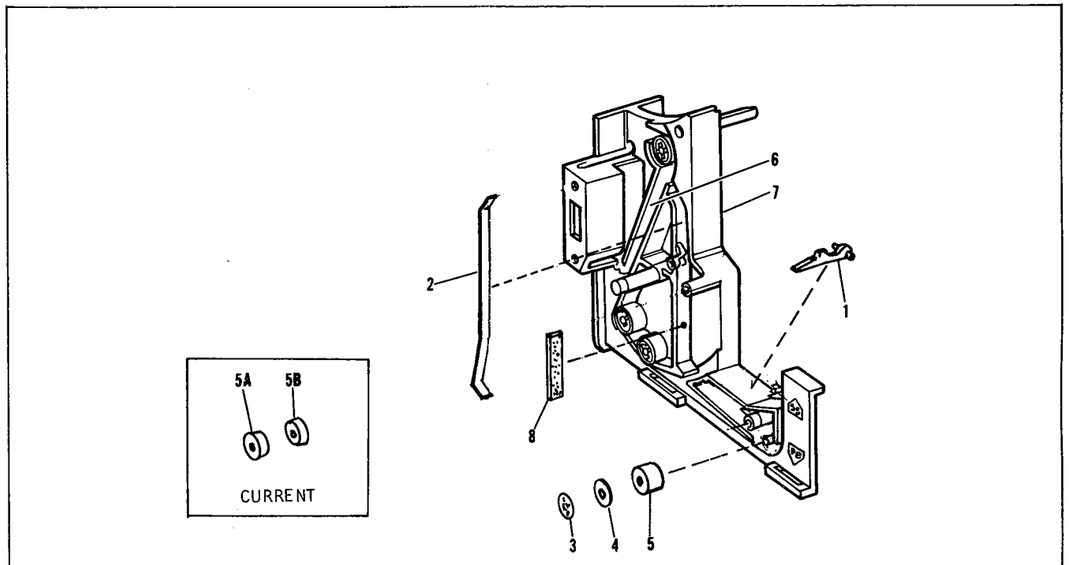


Figure 6. Lower Film Guide Assembly

FIG. & INDEX NO.	PART NO.	DESCRIPTION 1 2 3 4 5 6 7	UNITS PER ASSY	USABLE ON CODE
		PUCK ARM ASSEMBLY		
7-	014833	ARM ASSEMBLY, Puck	REF	
-1	46191	. SCREW, Phillips hex head, 4-40NC	1	
-2	39223	. NUT, Hex	1	
-3	9240	. WASHER, Flat	1	
-4	46122	. SPRING, Compression	1	
-5	46026	. DISC, Clutch	1	
-6	46189	. WASHER, Fiber	1	
-7	45808	. GEAR, Idler	1	
-8	46190	. WASHER, Clutch	1	
-9	45818	. CLUTCH, Base	1	
-10	45808	. GEAR, Idler	1	
-11	17676	. RING, Retaining, external Type E, 0.156 inch ID	1	
-12	015295	. GEAR AND SHAFT ASSEMBLY	1	
-13	45830	. ARM, Puck	1	

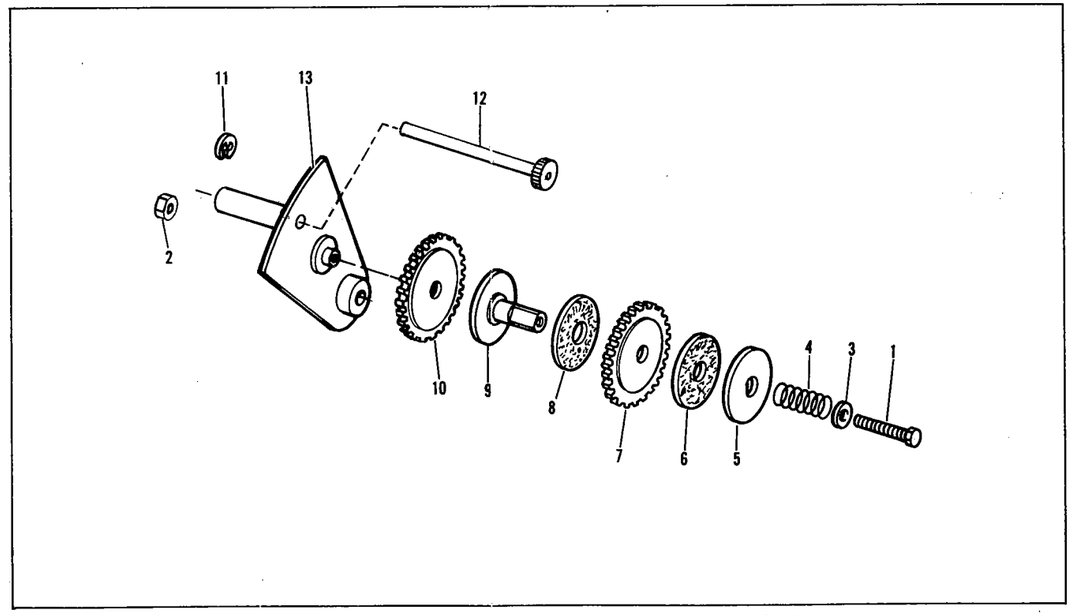


Figure 7. Puck Arm Assembly

FIG. & INDEX NO.	PART NO.	DESCRIPTION 1 2 3 4 5 6 7	UNITS PER ASSY	USABLE ON CODE
		MECHANISM MODULE ASSEMBLY		
8-	014830	MODULE ASSEMBLY, Mechanism	REF	A
8-	014850	MODULE ASSEMBLY, Mechanism	REF	B
-1	45861 45942	SHOE, Pressure	1	
-2	36844	. SCREW, Pan head, 6-32 by 5/8 inch	2	
-3	46167	. NUT, Square, 6-32	2	
-4	45802	. MODULE, Rear	1	
-5	015311	. BRACKET ASSEMBLY, Bearing support	1	
-6	46128	. BELT, Drive	1	
-7	40567	. RING, Retaining, push-on	2	
-8	46052	. SHIELD, Lamp	1	
-9	766182	. SCREW, Hex washer head, 6-32 by 5/16 inch	2	
-10	46167	. NUT, Square, 6-32	2	
-11	46040	. RETAINER, Bearing	1	
-12	46131	. BEARING, Main shaft	1	
-13	36837	. SCREW, Pan head, 4-40 by 1/4 inch	2	
-14	42154	. NUT, Hex Sems, 4-40	2	
-15	46134	. SOCKET, Lamp	1	
-16	46043	. SPRING, Focus knob retaining	1	
-17	45812	. KNOB, Focus	1	
-18	46096	. SPRING, Tension	2	
-19	706402	. SCREW, Slotted pan head, 4-40 by 3/16 inch.	1	
-20	015319	. LEVER ASSEMBLY, Face tension	1	
-21	39223	. NUT, Plain hex, 4-40	4	
-22	36837	. SCREW, Pan head, 4-40 by 1/4 inch	3	
-23	37343	. SCREW, Fillister head, 4-40 by 1/4 inch	1	
015227 -24	014831	. APERTURE PLATE ASSEMBLY	1	
-24A	40531	. . SPRING, Side tension	1	
-24B	46021	. . ARM, Side tension	1	
-25	45922	. SLIDER, Aperture retractor	1	
-26	12498	. SETSCREW, Fluted socket cup pt, 6-32 by 1/8 inch	1	B
-27	45825	. LEVER, Multi-motion	1	B
-28	44987	. CAM, Multi-motion	1	B
-29	145	. BALL, Detent	1	B
-30	45460	. SPRING, Compression	1	B

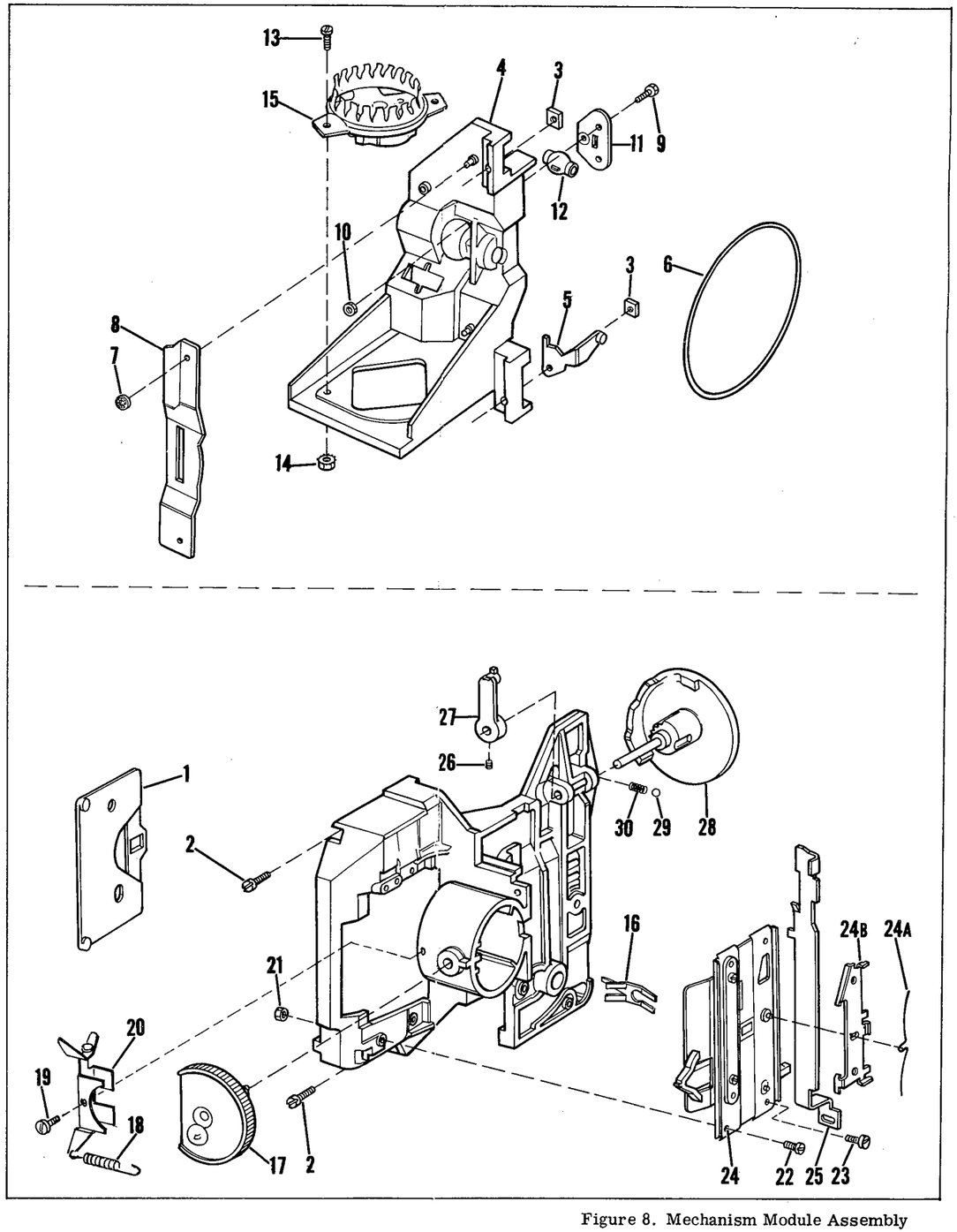


Figure 8. Mechanism Module Assembly

FIG. & INDEX NO.	PART NO.	DESCRIPTION 1 2 3 4 5 6 7	UNITS PER ASSY	USABLE ON CODE
		MECHANISM MODULE ASSEMBLY (CONT'D)		
9-1	10640	. SCREW, Pan head, 2-56 by 1/8 inch	1	
-2	46061	. BRACKET, Mask shifter	1	
-3	46112	. SPRING, Tension	1	
-4	40567	. RING, Retaining, push-on	1	
-5	40492	. WASHER, Flat	1	
-6	46090	. LEVER, Format stabilizer	1	
-7	36837	. SCREW, Pan head, 4-40 by 1/4 inch	1	
-8	30613	. WASHER, Flat	1	
-9	39223	. NUT, Plain hex, 4-40	1	
-10	015317	. BRACKET ASSEMBLY, Format shifting	1	
-11	80591	. SETSCREW, Fluted socket cup pt, 6-32 by 3/16 inch	1	
-12	014837	. SHUTTER ASSEMBLY	1	
-13	26906	. NUT, Hex Sems, 6-32	1	
-14	36847	. SCREW, Pan head, 6-32 by 1-1/4 inch	1	
-15	39027	. WASHER, Spring tension	1	
-16	43857	. WASHER, Flat, 7/16 inch OD	1	
-17	766147	. SCREW, Hex washer head	1	
-18	41733	. WASHER, Flat, 5/8 inch OD	1	
-19	015316	. PLATE ASSEMBLY, Shuttle adjustment	1	
-20	015315	. SHUTTLE ASSEMBLY	1	
-21	32947	. CAM SHOE, White (see NOTE A)	AR	
-21	33712	. CAM SHOE, Black (see NOTE A)	AR	
-22	26085	. WASHER, Shim	2	
-23	46179	. CAM, Pull-down	1	
-24	45877	. DRIVER, Cam	1	
-25	80591	. SETSCREW, Fluted socket cup pt, 6-32 by 3/16 inch	1	
-26	46008	. GEAR, Drive	1	
-27	46003	. SPACER, Bearing	1	
-28	45960	. SHAFT, Main	1	
-29	26131	. RING, Retaining, crescent, 0.219 inch ID	1	
-30	30667	. WASHER, Flat	1	
-31	20808	. RING, Retaining, 0.145 inch ID	1	
-32	34878	. WASHER, Flat	1	
-33	43815	. SCREW, Special	1	
-34	46031	. PLATE, Guide	1	
-35	29694	. RING, Retaining, 0.125 inch ID	1	
-36	46949	. GEAR, 18/54 tooth	1	
-37	015318	. GEAR TRAIN ASSEMBLY	1	
-38	45971	. SCREW, Shoulder special	1	
-39	45878	. WASHER, Flat	1	
-40	46164	. SPRING, Torsion	1	
-41	80962	. RING, Retaining, Type E, 0.375 inch ID	1	
-42	015314	. ARM ASSEMBLY, Forward/Reverse	1	
-43	30237	. SCREW, Hex head tapping, 4-40 by 1/4 inch	1	
-44	46157	. SPRING, Torsion	1	
-45	45946	. SPACER, Flanged	1	
-46	014847	. FIRE SHUTTER ASSEMBLY	1	
-47	45321	. SCREW, Pan head tapping, 2-32 by 3/8 inch	1	
-48	46039	. SPRING, Retractor	1	
-49	45813	. LEVER, Shuttle retractor	1	
-50	117139	. SCREW, Plain hex head, 6-32 by 3/8 inch	1	
-51	46037	. NUT, Special	1	
-52	83957	. SCREW, Slotted hex head, 6-32 by 1/4 inch	1	
-53	46167	. NUT, Square, 6-32	1	
-54	46037	. RETAINER, Bearing	1	
-55	46131	. BEARING, Main shaft	1	
-56	765449	. RING, Retaining, 0.188 inch ID	2	
-56	765449	. RING, Retaining, 0.188 inch ID	1	
-57	43162	. SPRING, Compression	1	
-58	015313	. SHAFT ASSEMBLY, Actuator	1	
-58A	44985	. . SCREW, Cam follower	1	
-59	015312	. MODULE ASSEMBLY, Front	1	

NOTE A: Use any combination of black and/or white cam shoes to obtain proper fit on pull-down cam.

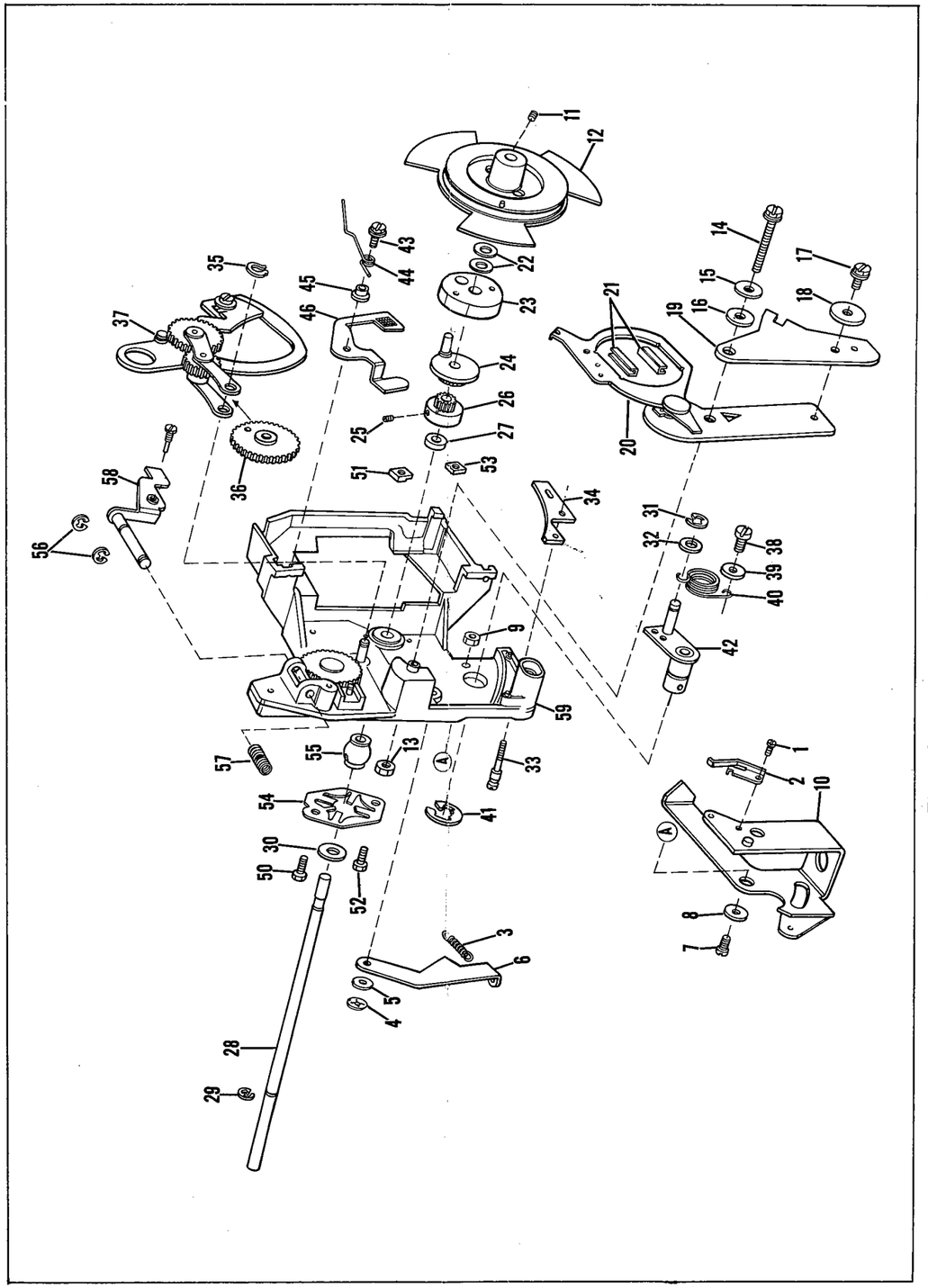
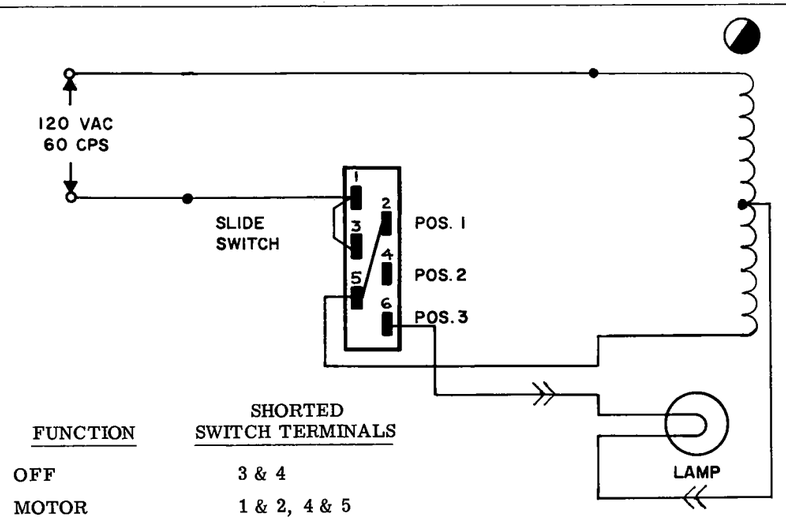
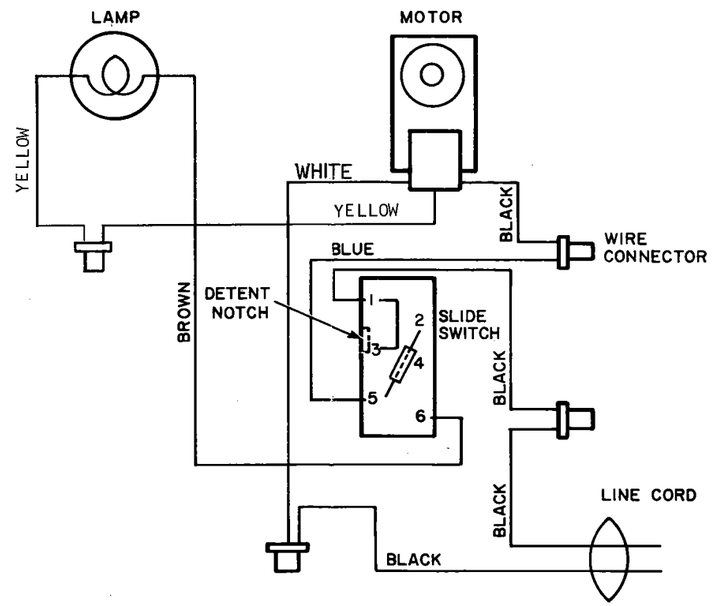


Figure 9. Mechanism Module Assembly (Continued)



POSITION	FUNCTION	SHORTED SWITCH TERMINALS
1	OFF	3 & 4
2	MOTOR	1 & 2, 4 & 5
3	MOTOR-LAMP	2 & 3, 5 & 6

SCHEMATIC



PICTORIAL

Figure 10. Projector Wiring Diagrams

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